United Nations ECE/CES/GE.20/2014/16

Economic and Social Council

Distr.: General
15 April 2014

English only

Economic Commission for Europe

Conference of European Statisticians

Group of Experts on National Accounts

Thirteenth session
Geneva, 6-9 May 2014
Agenda item 2
Progress with national implementation plans for the System of National Accounts

Implementation of the System of National Accounts 2008 and the Government Finance Statistics Manual: Main conclusions of the workshop for the countries of Eastern Europe, Caucasus and Central Asia and South East Europe

Prepared by UNECE Secretariat

Summary

The workshop on the Implementation and Links between the System of National Accounts 2008 and the Government Finance Statistics Manual 2014 was organized following the recommendations of the Group of Experts on National Accounts and as a part of the regional initiatives to support the implementation of the new statistical standards in the countries of Eastern Europe, Caucasus and Central Asia and South East Europe. It also aimed at strengthening the cooperation between the national accounts and government finance statistics compilers. This paper summarises the main conclusions and recommendations of the workshop.

GE.14-21994

1421994

Please recycle

I. Introduction

1. The workshop on the Implementation and Links between the System of National Accounts 2008 (2008 SNA) and the Government Finance Statistics Manual (GFSM) was held in Istanbul on 20-22 November 2013. It was jointly organized by the European Free Trade Association (EFTA), Eurostat and UNECE, in cooperation with the International Monetary Fund (IMF) and the Turkish Statistical Office (Turkstat).

2. The workshop was attended by participants from the National Statistical Offices (NSOs) and Ministries of Finance or Central Banks from the following countries: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Croatia, Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Montenegro, Serbia, Tajikistan, The former Yugoslav Republic of Macedonia, Republic of Moldova, Tajikistan, Turkey, Turkmenistan, Ukraine and Uzbekistan, and representatives from the Statistical Agency of Kosovo, the Eurasian Economic Commission (EEC), Interstate Statistical Committee of the Commonwealth of Independent States (CIS-STAT) and the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP).

II. Organization of the workshop

3. The workshop was prepared following the recommendations of the Group of Experts on National Accounts (April 2012, Geneva) and is part of the regional initiatives to support the implementation of the System of National Accounts 2008 (2008 SNA)/ European system of national and regional accounts (ESA 2010) and the Government Finance Statistics Manual 2014 (GFSM 2014) in the countries of Eastern Europe, Caucasus and Central Asia (EECCA) and South East Europe (SEE). Its main goal was to strengthen the cooperation between the national accounts and government finance statistics compilers and to discuss the implementation and links between the 2008 SNA, ESA 2010 and the GFSM.

4. The following substantive topics were discussed on the basis of presentations and supporting documentation:

(a) Coherent and integrated macroeconomic statistics for policy purposes;

(b) Implementation of the revised international statistical standards: 2008 SNA, ESA 2010 and GFSM 2014;

(c) Main issues and way forward.

5. All materials of the workshop are available at:
http://www.unece.org/stats/documents/2013.02.sna.html

III. Summary of the main conclusions reached at the workshop

6. The participants of the workshop:

(a) *Recognized* that the efficient implementation of the 2008 SNA and GFSM 2014 requires close cooperation between the national statistical offices, ministries of finance and/or central banks and other statistical stakeholders.

(b) *Recommended* that countries should establish permanent inter-institutional working groups (IWG) to facilitate coordinated and coherent implementation of the 2008 SNA and related macroeconomic standards, particularly BPM6 and GFSM. In respect to the IWGs the participant also noted that:

- The IWG should be at the level of heads of respective divisions/units in the national statistical institutes, ministries of finance and/or central banks, who are able to take decisions for the statistical methodology and compilation techniques. Other relevant departments/institutions could also be involved;

- When needed, the IWG could be supported by more technical experts groups addressing concrete issues;

- The IWG should have an agreed mandate, specifying the tasks and objectives, lead institutions on each task, timeframe, reporting obligations, as well as the type of decisions they can take and implement.

(c) *Stressed* the importance of high-level support for the functioning of the IWG at the managerial level of the respective institutions. This support should facilitate the exchange of data and ensure the implementation of the main decisions of the IWG. The cooperation should preferably be defined in a memorandum of understanding or other form of formal agreement between the institutions.

(d) *Emphasized* the role of international organizations to promote and strengthen the institutional cooperation in the countries by:

- Requesting that any decisions affecting statistics on the government sector are systematically discussed and agreed between the MoF, Statistical offices, national banks and other partner organizations in the country;

- Involving participants from all concerned organizations during technical assistance activities;

- Providing training and forums to share good practice.

(e) *Recommended* that the institutional sector classification should be consistently applied in national accounts, government finance statistics and related macroeconomic data sets. The national statistical offices should have a leading role in ensuring that SNA concepts, notably as far as the market/non market units distinction is concerned, are used as underlying principles for the sectorization and harmonization across statistical systems.

(f) *Underlined* that an agreed list of the units in the government sector and sub-sectors is the first step to ensure the required necessary quality, coverage and coherence of all government sector statistical data sets. In respect to the institutional sector classification the participants also noted that:

- The list of general government units and their sub-sectorization could be discussed and agreed by the IWG;

- Rules for maintenance and regular updates of the list of government units should be established;

- The statistical business register is the appropriate tool/or should provide the infrastructure though which agreed institutional sector classification (and related classifications) is consistently used by all compilers of statistics. This may involve resolving a number of technical issues as well as establishing access rules, addressing confidentiality and legislative issues;

- Technical support and a platform for sharing good practices are needed to help countries to address the above issues.

(g) *Encouraged* countries to put in place full set of accounts for the governments sector and highlighted the importance of reconciliation between national accounts and government finance statistics. Reconciliation is a powerful tool to identify data gaps and methodological problems and to improve the quality of both macroeconomic data sets.

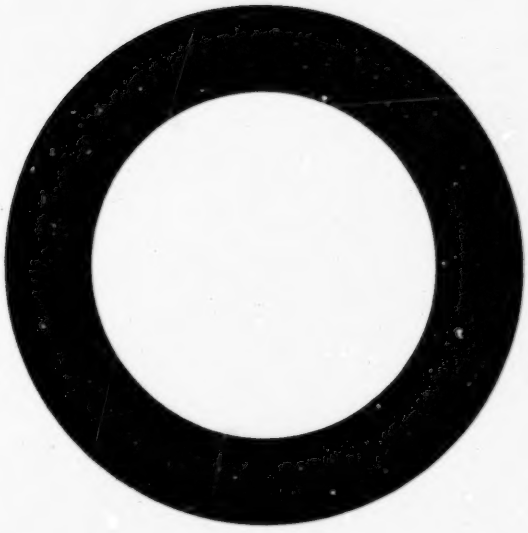
(h) In addition to the main priorities listed above, *identified* the areas where further work is important:

- Improving the availability, quality and timeliness of data sources;
- Harmonization of the national accounting practices with internationally agreed standards;
- Implementation of accrual recording for all expenditure and revenue;
- Improvements in the used classification of transactions and assets;
- Development of balance sheets and estimates of capital formation and consumption of fixed capital of government units.

(i) *Highlighted* the need of proper documentation of main decisions, methodological and data issues, in order to ensure continuity of work, transparency and transfer of knowledge.

(j) *Recognized* the need of good communication strategy on the relevance and importance of government sector statistics for evidence based policy making.

(k) *Welcomed* the proposal to post the responses to the questionnaires "Institutional arrangements and methodological issues in the compilation of statistics on the General Government Sector" in order to allow countries to learn from each other experience. UNECE will translate all replies and will send them to the countries for verification.



United Nations ECE/CES/GE.20/2014/17

Economic and Social Council

Distr.: General
10 April 2014

English only

Economic Commission for Europe

Conference of European Statisticians

Group of Experts on National Accounts

Thirteenth session
Geneva, 6-9 May 2014
Item 5 of the provisional agenda
Expanded accounts for the Household sector including non-profit institutions, serving households (NPISH)

Service Lives of Research and Development Assets: comparing survey and patent based approaches

Prepared by the United Kingdom Office for National Statistics

Summary

This paper draws together Office for National Statistics research into the service lives of Research and Development assets which will be capitalised in the National Accounts from 2014. The characteristics of service lives are considered and results from two sources are presented; a new question on service lives implemented on the United Kingdom's Research and Development surveys, and estimates derived from Patent administration data. These are compared and theoretical underpinnings, strengths, and limitations discussed.

GE.14-21934

1421934

Please recycle

I. Introduction

1. The 2008 revision of the System of National Accounts (SNA) (United Nations, 2009) requires Research and Development (R&D) expenditures to be treated as investment in knowledge assets. This reflects the contribution of the knowledge produced through R&D to production and output over multiple years. This new information will provide insight into the role of knowledge in the economy, the allocation of resources to R&D, and will improve understanding of the relationship between knowledge and productivity. Capitalisation also recognises R&D assets in the National Balance Sheet and therefore affects the measurement of National Wealth.

2. The change poses a variety of challenges for National Accountants. In particular, much effort has been invested in developing methods for measuring the knowledge assets produced (also referred to as 'R&D assets'). Having established an appropriate valuation for R&D assets, it is then necessary to establish which sectors have economic ownership of them (see Steer & Ker (2013)) and to establish how long they are useful for.

3. This paper provides an overview of Office for National Statistics (ONS) research into the useful lives of R&D assets.

II. Service Lives

4. The service life of an asset is *'the total period during which it remains in use, or ready to be used, in a productive process'* (Organisation for Economic Co-operation and Development (OECD), 2001, p. 95). Put simply, the service life of an asset is the number of years for which it is useful to its owner(s) in generating returns. During its service life an asset may have more than one owner.

> *"Asset life is understood here as an economic notion, and not as a physical or engineering notion of capital goods. This is important because it implies that assets can change over time simply due to economic considerations even if the asset remains physically unchanged"* (OECD, 2009, p. 106).

5. Typically, the end of an asset's useful life may result from economic obsolescence, wear and tear, or loss through accidental damage. For R&D, the majority of these concepts have no meaning due to its intangible nature; knowledge does not suffer from 'wear and tear', nor can it be 'accidentally damaged' or subsequently 'repaired'. It has a theoretically infinite lifespan.

6. However, the length of time over which knowledge directly contributes to economic output and to companies' profits is different and is thought of as the 'economic service life', which will usually be finite. The finite nature of the economic service lives of R&D can be explained by 'creative destruction' where knowledge can be rendered obsolete and displaced by new discoveries (Bitzer & Stephan, 2007). Peleg (2008) found evidence that the use of knowledge may be gradually scaled back over time suggesting a gradual superseding of the R&D or a process of gradual spill-over whereby, over time, the knowledge becomes available more widely until it is common knowledge and of no remaining specific value to its owner. R&D 'depreciates' therefore because it makes a decreasing contribution to owners' profits and to economic output over time.

A. Why Service Lives Matter

7. Aside from the volume of R&D investment itself, service lives of R&D assets are the main determinant of the R&D stock used in analyses of productivity and National Wealth. Service lives are key inputs to the Perpetual Inventory Method (PIM) used to compile asset stocks (see ONS, 2008); they are parameters to survival functions which adjust for obsolescence; age-price (depreciation) functions which estimate the decline in assets' values as they age; and age-efficiency functions which estimate the age-related decline in efficiency. As a result:

> *"the accuracy of capital stock estimates derived from a PIM is* ***crucially dependent*** *on service lives - i.e. on the length of time that assets are retained in the capital stock, whether in the stock of the original purchaser or in the stocks of producers who purchase them as second hand assets"* (OECD, 2009, p. 106).

8. Shorter service lives give greater weight to more recent innovations in capital stock estimates (Australian Bureau of Statistics, 2009, p. 48), as (OECD, 2010, p. 33) clarifies;

> *"Specifying a service life of 10 years rather than 5 years would make a huge difference to estimates of capital measures. Net capital stock would be approximately double, and with a typical scenario of strong growth, consumption of fixed capital would be appreciably smaller."*

9. The importance of reliable service lives for R&D assets is heightened by the use of sum-of-costs valuation for R&D (where the value of R&D produced is set equal to the total costs incurred in its production). In a fully integrated system, the contribution of existing R&D capital to the production of further R&D would be included amongst the costs summed; the effect of this on output and hence Gross Domestic Product is partially determined by the service life adopted for R&D assets.

B. European Task-Force Recommendation

10. Relatively few countries have produced R&D life estimates of any sort and the recommendation of the Second European Task-Force on R&D Capitalisation offered the pragmatic alternative of *ten years* as a default in the absence of empirical information:

> *"Service Life estimates used in the calculations of R&D should be based on dedicated surveys or other relevant research information, including information of other countries with comparable market/industry characteristics. In cases, where such information is not available, a single average Service Life of 10 years should be retained.*
>
> *It is also recommended that the above mentioned Service Life estimates should be investigated regularly, e.g. every 10 years."* (Eurostat, 2012)

11. However, there is no reason to assume that R&D service lives are equal between sectors in the same economy and much less between different countries with varied industrial mixes. Nor is it likely that the 'European average service life of R&D' happens to be 10 years – the minimum of the range suggested by the OECD (2010, p. 62). Furthermore, standardising the service life across countries removes one of the key determinants of the knowledge capital stock leaving the volume of R&D investment as the sole explanatory variable for countries' differing economic performance.

III. Estimating R&D Service Lives

12. Each individual asset will have a unique service life; two identical machines will not usually last the same amount of time before wearing out. In the case of R&D, no two knowledge assets are the same (by definition) and thus will have different useful lives. However, it is not viable to collect data at the asset level and instead information on typical lives for different types of assets (such as buildings, machines, vehicles, R&D) is used.

13. Though average lives receive the most attention, in general three descriptive statistics are needed for the estimation of the various functions used in the PIM;

> *"The average or mean service life has to be distinguished from the maximum service life of a cohort of assets because the service lives of the same assets within a cohort are normally described by a retirement or mortality function which defines the distribution of asset retirements around the mean and between the minimum and maximum service lives" (OECD, 2009, p. 106).*

14 The average, minimum, and maximum lives are likely to vary across:

- asset types – the average service live for R&D asset is likely to be less than for a building for example; similarly 'Basic Research' could generally have a useful life different to 'Applied Research' for example
- industries and products – aeronautical knowledge may generally be useful for longer than knowledge in software for example
- Institutional sectors - government-produced R&D may last longer on average than businesses' R&D for example
- Time periods – the pace of technological change is likely to vary over time

15. A practical and affordable source is needed to provide sufficient detail to capture the essential variation in R&D lives over these characteristics.

IV. Sources of Information

16. As R&D is not usually treated as capital investment in financial reporting standards, tax lives and information from company accounts commonly used for other assets are unavailable. Expert opinions have provided useful information for some types of assets, but for R&D, survey questions and analyses of data from patent administration are generally the most favoured sources of service life estimates.

17. This research compares and contrasts two approaches for estimating service lives of United Kingdom's (UK) R&D assets: Survey of business R&D service lives and the method based on the information on the payment of annual patent renewal fees.

A. Survey of business R&D service lives

18. The UK has conducted one of the largest surveys of business R&D service lives to date with 650 responses to a new question introduced to the UK Business Enterprise R&D Survey (BERD) from 2011 onwards. The wording was developed from a question used in the earlier 'Investment in Intangible Assets' survey and was improved through two rounds of pilot testing. It asked: "How long does the business expect to benefit from a typical investment in 'Basic Research', 'Applied Research', and/or 'Experimental Development'?"

19. These different 'types' of R&D are defined in the OECD Frascati Manual (OECD, 2002), which provides the internationally accepted framework for measuring R&D. They are also used in other questions on UK the R&D surveys. They are differentiated in their degree of focus on specific applications or products.

20. The question was included on the BERD 'long form' which is sent to the businesses which spend the most on R&D (covering around 80 percent of all business R&D expenditure). Responses were received from 86 per cent of these firms. The question was also included on all forms in Northern Ireland which adds some coverage of firms which spend less on R&D, though the response rate was much lower. In total, the results directly represent over 66 per cent of UK business R&D (based on their 2011 current expenditure).

21. The paper "*Service Lives of R&D Assets: Questionnaire Approach*" (Ker, 2013a) provides further detail on the development of this question and analyses conducted to derive these results.

B. Information on the payment of annual patent renewal fees

22. Information on the payment of annual patent renewal fees can also be used to make inferences about the lives of R&D protected by patents. ONS used information extracted from the UK Intellectual Property Office (IPO) and European Patent Office (EPO) patent administration systems, and covers patents filed and/or approved between 1986 and 2010.

23. Each patent's 'life' can be taken as the number of years (from application) over which the patent is renewed through the payment of the relevant fees. In the UK, fees vary between £75 in the first year of payment up to £600 in the 21st year after application. Every year, each patent's owners choose whether or not to renew; it can be asserted that if the patent is renewed, its value must at least be equal to the cost of renewal and therefore the knowledge asset still exists.

24. The patent lives estimated can be used to draw conclusions about the service lives of R&D assets by assuming that patents represent R&D.

25. ONS used 'fuzzy matching' to match the patents to businesses based upon details such as the name and address of the owner. Where this was successful it provides further information on the characteristics of the owner (notably their industry).

26. The paper "Service *Lives of R&D Assets: Patent Approach*" (Ker, 2013b) provides greater detail on the patent data used and the methods applied.

27. This paper compares the survey and patent-based methods both theoretically and in the context of results for the UK, and looks at the implications of choosing one over the other.

V. Strengths and Limitations of these Sources

28. The questionnaire approach specifically targets the benefits which accrue from R&D the respondent has undertaken. In contrast, only some R&D will be patented, and also some patents may relate to knowledge or ideas produced through channels other R&D (i.e. the coverage of patents may be broader than the definition of R&D defined in the Frascati Manual).

29. However, there are several difficulties in using a survey question approach. The questions used are often of a general nature; this is the case in the UK where R&D is only split into 'basic research', 'applied research', and 'experimental development'. Providing a single figure estimate of the period over which benefits will accrue (i.e. an estimate of the

average for R&D projects undertaken by the responding business) can require the respondent to attempt to aggregate over a large number of different R&D projects. They also may or may not factor in R&D which is deemed unsuccessful (i.e. providing no benefit). The approach relies upon respondents' ability to meaningfully average across their R&D projects and programmes and the sample design will affect how well results can be generalised to R&D more widely

30. Despite this, pilot testing of the ONS question showed that respondents understood the principle and could provide an answer. By contrast, the US Bureau of Economic Analysis (Li, 2012) found that respondents could not answer such general questions and instead had success when asking about benefits delivered by a specific product embodying R&D.

31. Patent sources benefit from providing direct observations of life lengths, rather than relying on respondents providing a robust estimate. However, patent analysis requires that the whole life of the patent has been observed, this can be up to 21 years and so the analysis will be less up-to date than survey estimates which can provide insight into changes in the rate of technological advance when conducted at regular interval (e.g. every 5-10 years).

32. The patent approach offers the possibility of producing estimates without expense and time required to collect data through a survey. Such sources provide a large number of direct observations on the lives of patents. However, it may not always be the case that patent holders only renew when the patent continues to be of use; some companies, especially those holding large numbers of patents, may renew by default as the cost of annually reassessing each patent may outweigh the relatively low renewal fees. Furthermore, with patent litigation continuing to increase amid growing awareness of the value of patents (PricewaterhouseCoopers (PwC), 2012) patent holders may also choose to renew as a precautionary measure or because the actions of other businesses *might* give the patent value in future.

33. More fundamentally, using patent lives as an indicator of R&D lives requires the assumptions that all patents embody R&D (as opposed to resulting from other processes). There is a logical relationship between R&D and the production of patents. However, the evidence suggests that in practice this link is not firm and will vary between industries. Furthermore, generalisation effectively requires the assumption that all R&D is patented (so that patent lives are assumed to be representative of all R&D). Meanwhile as the analysis is 'backwards looking' it requires that the patent lives derived for the period 1986 – 2010 can be applied to other periods, foregoing the possibility that lives may be altered by changes in the pace of technological advance.

VI. Comparison of Methods

A. Mean and Median Average Lives

34. The analysis showed that both the questionnaire and patent data were highly positively skewed because longer lives (i.e. periods over which benefits from the R&D accrue) of 25 years or more are much less common than shorter lives. This means that there is a large peak in the frequency distributions between 5 and 15 years and a long right hand tail (illustrated in Ker 2013a, Ker 2013b). The data remained skewed even after the optimal Box-Cox transformation (Box & Cox, 1964) (Osborne, 2010) had been applied.

35. This has implications for the descriptive statistics (and tests of statistical significance) used. As explained in Kitchen (2009), the presence of only one arbitrarily large outlier the mean becomes arbitrarily large; by contrast, the median will not

breakdown as long as only a minority of observations are corrupted. As such, in the presence of skewed data such as this, the median is likely to provide a better estimate of central location.

36. Some analyses (such as Australian Bureau of Statistics, 2009) have tended to take mean rather than median lives. For the purposes of this research, both were calculated so that the differences between them may be observed.

B. Weighted and un-weighted averages

37. Another choice is the use of simple average lives or applying weights with the aim of deriving estimates that are more representative.

38. Survey responses were weighted by the firms' shares in total (current) expenditure on R&D so that service life estimates provided by firms that spend more on R&D were given more weight.

39. Researchers at Statistics Netherlands (Tanriseven, van Rooijen-Horsten, & de Haan, 2010) proposed to weight the distribution of patent lives based upon information from the 'PatVal' study (Gambardella, Giuri, & Mariani, 2005). This study surveyed the inventors of over 9,000 patents accross 5 European Union (EU) countries (France, Germany, Italy, The Netherlands, Spain, UK) and used a hypothetical question to elicit an estimate of the financial worth of the patent on the day it was approved. This is used to weight the observed patent lives by assuming a perfect correlation between patents' longevity and their value - i.e. the longest-lived patents are assumed to be more valuable and these are given more weight as the lives of the most valuable patents are of most interest.

40. Such value-weighted patent lives are also calculated for the UK for the purposes of comparison. However, the emphasis of the PatVal survey on the patents which are likely to be most valuable (those which have been cited or contested), plus the strong assumption required about the correlation between patent longevity and value mean that this approach should be used with care. Furthermore, for most countries not covered by PatVal, this option will not be available and thus its adoption in only a few countries may reduce international comparability.

C. 'Censoring' in Patent Data

41. The patent data are extracts from live administrative systems which are updated as patents are filed, approved (or denied), renewed, etc. They cover patents filed and/or approved in the 24 years between 1986 and 2010. Importantly, this is only slightly longer than the maximum renewal period of 21 years and only those patents filed before 1989 would have had the opportunity to reach the full 21 years. As a result these extracts cover not only patents which have ceased being renewed ('died') but also provides many more observations of patents which have been filed and approved but were still being renewed in 2010. These cases are described as 'right censored'.

42. While the information about these patents is incomplete (because they will die in periods after 2010), this partial information can be valuable; for example, if we observe that a patent was filed in 1995 and is still being renewed in 2010, we can see that, when it does stop being renewed, it will have survived *at least* 15 years. Focussing only on patents for which death was observed disregards such useful information and, due to the narrow band of years covered (i.e. only 24 years), has a considerable downward bias on the results.

43. Kaplan-Meier Survival analysis techniques make use of all the information available – both on patents which died during the period and on those which existed but did not die

before the end of the period covered by the data. This reduces the downward bias present in other methods.

D. Summary of Methods

44. Table 1 summarises the key features, assumptions, benefits, and limitations of estimates derived from survey and patent sources.

Table 1
Comparison of methods for estimating R&D service lives

	Questionnaire	*Patent Lives*	*Patent Lives w/ value weighting*	*Patent survival analysis*
Method	Survey question asking about *'expected benefit from a typical investment in R&D'*	Use data on patent renewals from patent administration systems to estimate number of years after patent application when patent 'death' (expiry/lapse) occurs	Patent analysis supplemented with patent value weights estimated from PatVal report (Gambardella, Giuri, & Mariani, 2005). Average of weighted and unweighted estimates taken	Kaplan-Meier survival method examines *all patents'* probability of survival to successive ages
Coverage	Target population is all R&D performers. Results represent around 66% of 2011 UK business R&D	All patents filed and/or approved in a given period (1986-2010 in this analysis) which also died in this period	All patents filed and/or approved in a given period (1986-2010 in this analysis) which also died in this period	Dead patents *and* patents which did not die in observation period
Advantages	Answers relate to R&D specifically. More forward looking (so more responsive to changing pace of technological change) than patent data	Potentially less costly and less time to implement than survey. Observed data from administrative source rather than expectations.	Giving greater weight to more valuable patents is theoretically desirable	Uses all information available; patents which died and those that outlived the observation period). Method built into statistical software (eg SPSS, STATA). Reduced downward bias compared to analysis of dead patents only
Disadvantages	Expectations rather than observations Incurs survey costs for design, testing, implementation, processing Takes time to achieve results Adds to respondent burden	Requires access to patent data. Backward looking – likely to be less responsive to changes in pace of technological change.	Requires access to patent data. Backward looking. Patent value information only available for a minority of EU countries.	Requires access to patent data. Backward looking. Reliability known to reduce as censoring increases. Median cannot be calculated if the survival probability function has not reached >50%
Key assumptions required	Respondents can average over their multiple R&D projects to provide meaningful answers. Responses can be generalised over all R&D.	Patents assumed to represent R&D. However, some businesses may choose alternatives e.g. industrial secrecy; - lags in granting disincentivise patenting knowledge with short expected benefit - 21 year maximum disincentivises patenting knowledge with long expected benefit Patents renewal implies remaining value; but holders may renew by default (especially those holding many patents) as renewal fees are relatively low (£600 max.)	Patents assumed to represent R&D. Strong assumption of perfect correlation between patent age and value.	Patents assumed to represent R&D.
Potential sources of bias	Sample focussed on businesses which spend the most on R&D. These firms also more likely to respond. Therefore results may be less representative of other firms' R&D. Responses gather at 'focal numbers' (eg 5, 10, 15 years, etc).	Examining only patents which died during the observation period will cause downward bias; data spans only 24 years, only patents filed before 1990 can reach maximum age (21) in this time. This issue is reduced with data covering longer periods.	Assumption of perfect correlation between patent age and value simply gives more weight to longer-lasting patents. This is likely to over-estimate the average service life.	Censoring increases downward bias. Maximum life of 21 years imposed by patent rules will reduce this effect. Still less bias than analysis of dead patents alone.

VII. Results

45. Table 2 presents median service lives derived using the different approaches. It is immediately apparent that the questionnaire data was only sufficient to sustain disaggregation to a number of key R&D performing industries including manufacturing. By contrast, the patent data facilitates the a more complete breakdown, though sample sizes are very small for 'Public administration and defence' and 'Activities of households as employers' and so these estimates should be treated with caution. The Kaplan-Meier survival method benefits from larger samples as it makes use of the information on patents observed to exist but which did not die before the end of the observation period in 2010.

46. Weighting questionnaire responses by firms' average shares in total business expenditure on each R&D type makes the overall median life longer. The effect is similar at the industrial section level, although the median life actually falls from five to four years in software. Confidence intervals are presented in Ker 2013a, Ker 2013b.

Table 2: Comparison of median lives from questionnaire and patent sources

	Questionnaire		Patent			
	Median	Expenditure weighted median	Median	Value weighted median	Average of medians	Kaplan-Meier survival median
Total	**6.0**	**10.0**	**8.0**	**20.0**	**14.0**	**20.0**
A - Agriculture, forestry, and fishing			8.0	20.0	14.0	12.0
B - Mining and quarrying			8.0	20.0	14.0	*
C - Manufacturing	7.0	8.0	9.0	20.0	14.5	19.0
D - Electricity, gas, steam, etc.			7.0	13.0	10.0	11.0
E - Water supply, sewerage, etc.			7.0	13.0	10.0	12.0
F - Construction			7.0	20.0	13.5	14.0
G - Wholesale and retail trade, etc.			8.0	20.0	14.0	17.0
H - Transportation and storage			9.0	20.0	14.5	15.0
I - Accommodation and food service			8.0	20.0	14.0	16.0
J - Information and comms (ex. software)	5.0	5.0	8.0	19.0	13.5	19.0
J - Software	5.0	4.0	6.0	12.0	9.0	*
K - Financial and insurance activities			8.0	20.0	14.0	20.0
L - Real estate activities			8.0	20.0	14.0	15.0
M - Professional, scientific and tech (ex. R&D)	5.0	5.0	7.0	20.0	13.5	19.0
M - Research & Development	10.0	12.0	9.0	20.0	14.5	20.0
N - Administrative and support activities			8.0	20.0	14.0	20.0
O - Public administration and defence, etc.			8.0	8.0	8.0	10.0
P - Education			8.0	20.0	14.0	*
Q - Human health and social work activities			9.0	20.0	14.5	16.0
R - Arts, entertainment, and recreation			7.0	20.0	13.5	12.0
S - Other service activities			8.0	20.0	14.0	20.0
T - Activities of households as employers			7.0	12.0	9.5	12.0
U - Activities of extraterritorial organisations	-	-	-	-	-	-
All other industries**	7.0	7.0	*8.0*	*20.0*	*14.0*	*20.0*

Source: ONS BERD 2011 (2012) and IPO patent data

- not published: low sample size

* median undefined (survival probability has not declined below 50%)

** for patent estimates this category is an aggregation of individual industrial sections provided for comparison purposes

47. Comparing the different sources, the questionnaire estimates are in the same approximate "ball-park" as the unweighted patent medians. This suggests that unweighted patent estimates may provide similar results to questionnaires. This holds at the aggregate

level but in some industries the spread between patent and questionnaire estimates is considerable (eg. three years in 'Information and communications excluding software). This might be because only longer-lived R&D is patented in this industry and so the survey results better reflect the average life of all R&D.

48. The value-weighted patent estimates are considerably higher as they place greater weight on longer-lasting patents. This may lead to upward bias of estimates, although selecting the median (rather than the mean) will mitigate this effect somewhat. Even so, it seems preferable to also take the 'average of averages' (the mean of the weighted and unweighted median estimates) to moderate the bias introduced as proposed by Tanriseven, van Rooijen-Horsten, & de Haan (2010).

49. The Kaplan-Meier survival estimates vary in their proximity to the other various patent estimates; in some cases they fall towards the lower end of the range between the unweighted median patent life and in other cases falling in line with the value-weighted estimates. This may result from some industrial sections generally holding the long-lived patents which are given more weight by taking values into account.

50. There is considerable variation across industry sections, suggesting that this dimension is important. The various approaches generally agree that service lives are shorter in software and longer in the R&D sector, which consists of both specialist research firms and the research branches of larger firms (where they have been separately identified and classified to this sector). As a result, the R&D performed by these businesses is likely to be highly heterogeneous.

51. Table 3 compares mean lives estimated from the different sources and approaches. As expected, the mean lives are generally considerably longer than the median lives (due to the bias discussed earlier) - though this is not the case for the value-weighted and Kaplan-Meier patent totals which are shorter than the medians. The variation here is generally similar to that of the medians in Table 2, although the questionnaire means and the unweighted patent mean life are even closer, lying within 1.3 years of each other. There is still considerable variation across industries.

Table 3: Comparison of mean lives from questionnaire and patent sources

	Questionnaire		Patent			
	Mean	Expenditure weighted mean	Mean	Value weighted mean	Average of means	Kaplan-Meier survival mean
Total	**8.2**	**10.5**	**9.5**	**18.8**	**14.1**	**16.9**
A - Agriculture, forestry, and fishing			8.7	18.6	13.6	13.5
B - Mining and quarrying			8.6	17.1	12.9	20.3
C - Manufacturing	8.6	10.0	9.5	18.7	14.1	16.7
D - Electricity, gas, steam, etc.			7.6	11.2	9.4	14.2
E - Water supply, sewerage, etc.			8.3	13.4	10.8	13.6
F - Construction			8.4	19.0	13.7	15.1
G - Wholesale and retail trade, etc.			9.5	18.6	14.0	16.1
H - Transportation and storage			10.0	18.8	14.4	15.7
I - Accommodation and food service			9.5	18.6	14.0	16.4
J - Information and comms (ex. software)	6.3	8.4	9.6	17.9	13.8	17.5
J - Software	5.1	4.1	7.1	10.8	8.9	19.3
K - Financial and insurance activities			9.7	19.5	14.6	13.7
L - Real estate activities			9.0	18.6	13.8	15.2
M - Professional, scientific and tech (ex. R&D)	7.4	7.4	8.4	18.5	13.5	16.4
M - Research & Development	10.9	13.8	9.7	18.6	14.2	17.9
N - Administrative and support activities			9.4	18.9	14.2	17.5
O - Public administration and defence, etc.			7.2	8.1	7.7	11.8
P - Education			9.2	17.3	13.3	18.5
Q - Human health and social work activities			9.9	18.8	14.3	16.7
R - Arts, entertainment, and recreation			7.9	18.1	13.0	12.8
S - Other service activities			9.1	19.0	14.1	16.9
T - Activities of households as employers			7.7	11.0	9.3	11.6
U - Activities of extraterritorial organisations	-	-	-	-	-	-
All other industries**	8.0	9.5	9.4	*19.0*	*14.2*	*16.7*

Source: ONS BERD 2011 (2012) and IPO patent data

- not published: low sample size

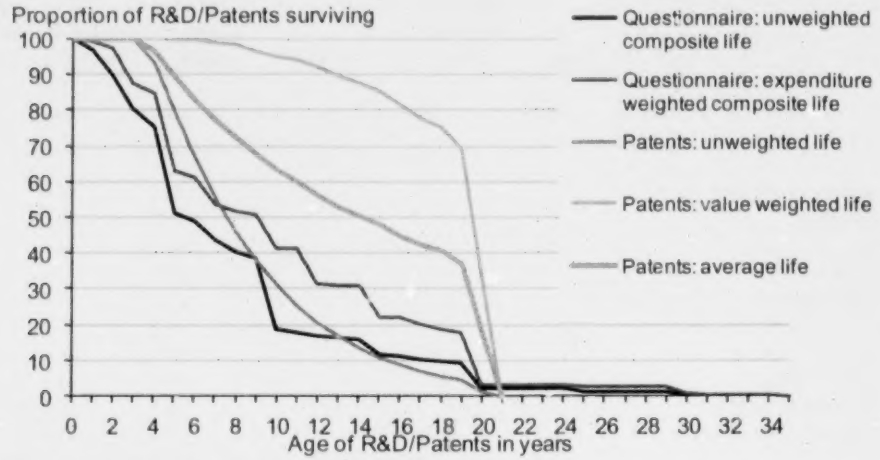
* median undefined (survival probability has not declined below 50%)

** for patent estimates this category is an aggregation of individual indistrial sections provided for comparison purposes

52. Comparing the survival profiles of R&D/patent lives from each source shows that survival from the questionnaire is quite similar to the profile given by unweighted patent estimates. By comparison, using the unweighted patent estimates would under estimate obsolescence in the first 7 years before falling approximately into line with the questionnaire based profiles. The average patent profile moderates the upward bias in the weighted profile and lies in the middle.

53. The figure also illustrates the impact of using patent data, which is (effectively) capped at a maximum life of 21 years. The survey responses suggest that around four per cent of R&D survives beyond 21 years but, though this proportion is small, the number of years further life is considerable at up to 35 years. This is relevant because maximum life estimates are also used in some implementations of the PIM.

Figure 1
Comparison of R&D Survival Profiles



Source: ONS BERD 2011 (2012) and IPO patent data

VIII. Comparison to Other Studies

54. Peleg (2008) reviewed depreciation rates and service lives from ten different studies covering differing geographical areas and time periods. They used various econometric models including approaches based on patent renewals. Findings showed (or implied through depreciation rates) average service lives ranging between 3.8 years and 18.2 years. Results varied considerably between industries and by R&D field (eg. 'Chemicals', 'Electrical Equipment', etc.), emphasising the need to consider these differences.

55. The majority of estimates lie within this range or slightly above it, although this is as much a product of the broad width of this range in the first place. These results also re-confirm the presence of considerable variation between industrial sections.

56. The average lives of R&D from UK questionnaires are all greater than that found by the United States National Science Foundation (NSF) which also conducted a large-scale survey (covering over 6,000 firms) in 2012. The question used asked about the life of products embodying R&D (that is, over how many years the business sold a product which made use of R&D). Although many firms did not provide responses, the survey gained almost 1,000 answers - making it the largest survey to date. The results gave an average of 5.46 years and showed variation between the 25 industries covered (Li, 2012). The most comparable estimate from the UK survey, the unweighted mean service life, is 8.2 years.

57. The unweighted mean patent life is 9.5 years in the UK, a little lower than the 11 years found by the Australian Bureau of Statistics (2009). Meanwhile, the unweighted median patent life of eight years is greater than the seven years found in The Netherlands (Tanriseven, van Rooijen-Horsten, & de Haan, 2010). The value-weighted median patent life was longer in the UK than The Netherlands at 20 years compared to 18 years in The Netherlands; influenced by comparatively higher values of UK patents. As a result, the UK 'average of averages' was also longer at 14 years compared to 12.5 years.

58. Comparing the unweighted survival profile to the Australian Bureau of Statistics and that implied by the survival probabilities provided by Tanriseven, van Rooijen-Horsten, &

de Haan, all share a very similar smooth declining pattern with little attrition over the first four years and an acceleration between 19 and 21 years.

59. Looking at the top level results in the context of the EU default of 10 years and the 10-20 year range suggested by the OECD (2010, p. 62) in Table 4 it is clear that while many of the estimates lie between 10 and 20 years, only in one case is the life estimated equal to the suggested default of 10 years. The median, weighted to reflect the relative shares of different respondents in total R&D output is also the most appealing questionnaire-based estimate. However, this could be driven by 'clustering' at focal numbers (e.g. 5, 10, 15, 20, etc) which can be observed in businesses' responses.

60. Furthermore, the breadth of alternative estimates available (the confidence intervals of which show that they are significantly different from 10) suggests that this is somewhat of a coincidence in the case of the UK. Estimates vary by industry and will overall average lives will therefore vary across countries with different industrial structures. The 10-20 year range is a useful guide but researchers should attach less significance to being within or outside this range than to the robustness of the methods chosen.

Table 4: Comparison of results by source

		Questionnaire: composite lives		Patent lives			
Estimate		Unweighted	Expenditure weighted	Unweighted	Value Weighted	Average of averages	Survival estimate
Median		**6.0**	**10.0**	**8.0**	**20.0**	**14.0**	**20.0**
Equals 10 year EU default?		✂	✓	✂	✂	✂	✂
In 10 - 20 year range?		✂	✓	✂	✓	✓	✓
	Lower	5.0	5.0	8.0	20.0	14.0	19.8
95% CI	Upper	7.0	12.0	8.0	20.0	14.0	20.2
	Includes 10 year EU default?	✂	✓	✂	✂	✂	✂
Mean		**8.2**	**10.5**	**9.5**	**18.8**	**14.1**	**16.9**
Equals 10 year EU default?		✂	✂	✂	✂	✂	✂
In 10 - 20 year range?		✂	✓	✂	✓	✓	✓
	Lower	7.8	8.4	9.4	18.7	14.0	16.8
95% CI	Upper	8.7	12.7	9.5	18.9	14.2	16.9
	Includes 10 year EU default?	✂	✓	✂	✂	✂	✂

Source: ONS BERD 2011 (2012) and IPO patent data

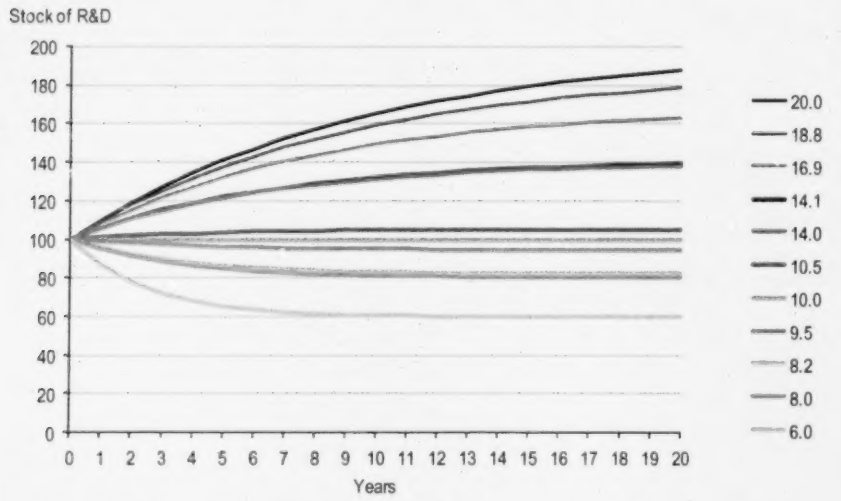
IX. Impact of Alternative Estimates

61. This research has provided considerable number of different estimates of R&D service life for the UK which range from 6 to 20 years. Aside from the volume of investment in R&D itself, the choice of average service life is a key determinant of the size of the R&D stock, which has implications for analysis of productivity and National Wealth.

62. Figure 2 presents a stylised illustration of the impact of using these different service life estimates in the Perpetual Inventory Method used to compile capital stocks in the National Accounts. The 'double-declining' geometric rate used here offers a convenient approximation of the integrated survival/age-price/age-efficiency profile (OECD, 2009, p. 97) accounting for the retirement of assets from productive use and for falling values (depreciation) and efficiency.

63. In this example, annual R&D investment is set at £20 to exactly offset this adjustment when the life is 10 years so that the R&D stock remains constant over time, with the initial stock set at £100. The vertical axis can therefore be interpreted as an index and shows that shorter lives then imply a shrinking R&D stock, while the longer lives imply different degrees of R&D stock growth.

Figure 2
Illustrative Impact of Different Service Lives on R&D Stocks



Source: ONS BERD 2011 (2012) and IPO patent data

64. In this example, over 20 years, a service life of 6 years (rather than 10) is consistent with a 40 per cent decline in the stock of R&D and therefore a move away from knowledge driven growth. By contrast, an R&D service life of 20 years would contribute to a rapidly expanding national stock of knowledge, with the stock continuing to grow beyond 20 years and doubling in 40 years. This is an extremely stylised example but it serves to demonstrate that in the real world the stock of R&D capital depends upon both the volume of investment in R&D and the period over which the resulting knowledge is useful.

65. Differentials in service lives will therefore also be a key determinant of international variation in R&D stocks and so of the effect that R&D has in different economies. As such,

the choice of service life is non-neutral and it is desirable to investigate the specific details in different countries.

X. Evaluation

66. This research has outlined two different approaches to estimating R&D service lives:

- survey questions gather expected or 'typical' service lives based on the assumption that respondents can correctly interpret the question and can provide consistent and meaningful answers
- patents provide observations on renewals based on the assumption that agents will only renew as long as the benefits outweigh the costs

67. Each offers different benefits and limitations; for example survey questions require money and time for design and implementation, and also add to respondent. Patent research may benefit from lower cost and time requirements, and offers a large amount of observed information. Industry analysis is also possible, though patents may first need to be matched to business information.

68. Both approaches require assumptions about generalisation of results to other R&D. However, while results from the BERD can claim to be representative of 80 per cent of UK business R&D, the strength of the link between R&D and patents is unclear; there are various reasons why business (and other types of organisation) may choose not to patent R&D including; the costs involved, lags between application and approval, and the renewal limit. Additionally, low renewal fees and precautionary motives may lead firms to renew by default rather than only when there is clear value to the patent, a fundamental assumption of the approach.

69. Generalisation over time is also an issue, and while survey questions might easily be re-run every five or ten years to collect benchmarks, patent data is backwards looking and most analytical methods require waiting to observe death. The Kaplan-Meier survival analysis techniques demonstrated address this to some extent.

70. Both methodologies classify based on the industry producing the R&D (or patent) but R&D may be sold or otherwise transferred across industries. However, the general nature of the question posed should mean that survey results are fairly representative of R&D invested in and used by the different industrial groupings (whether it is created on own account or bought in). The more specific nature of patent analysis, coupled with the potential for bias in the 'fuzzy matching' of patents to businesses does not afford this approach the same level of resilience.

XI. Conclusions

71. There are three key points which should be drawn from this analysis:

- Service lives vary between industries; therefore national average lives will vary based on countries' differing industrial structures. It is therefore theoretically undesirable to standardise the service life across country as this neutralises one of the two key determinants of the R&D stock.
- Countries making different choices between these data sources, and between different analytical methods to apply to that data introduces artificial variation between countries. This will reduce our ability to compare meaningfully across countries

- The service life of 10 years offered as a 'pragmatic' option by the European Task Force on R&D Capitalisation does appear to be the most appropriate focal number (i.e. 10 is better than 5, 15, or 20)

72. On the basis of this full and thorough analysis of Business R&D service lives results, the ONS proposes to adopt weighted median service lives estimated from the survey data. While the level of industry disaggregation is less satisfactory, this approach offers the advantage of being clearly linked to R&D.

73. Correct understanding of the impact of R&D on the economy and on productivity can only be gained by using data and methods that produce results of sufficient detail and accuracy. One key parameter determining the size of the R&D stock and thus the economic impact of R&D capitalisation is the service life adopted. Estimating R&D service lives is challenging, but this research provides a detailed comparison of two popular methods.

XII. References

Australian Bureau of Statistics. (2009). *Implementation of New International Statistical Standards.* Canberra: Australian Bureau of Statistics.

Bitzer, J., & Stephan, A. (2007). A Schumpeter-Inspired Approach to the Construction of R&D Capital Stocks. *Applied Economics* , 153-167.

Box, G., & Cox, D. (1964). An Analysis of Transformations. *Journal of the Royal Statistical Society* , 211-252.

Eurostat. (2012). *Second Task Force on the Capitalisation of Research and Development in National Accounts: Final Report.* Luxembourg: European Commission, Eurostat.

Gambardella, A., Giuri, P., & Mariani, M. (2005). *The Value of European Patents.*

Ker, D. (2013b). *Service Lives of R&D Assets: Patent Approach.* Newport: Office for National Statistics.

Ker, D. (2013a). *Service Lives of R&D Assets: Questionnaire Approach.* Newport: Office for National Statistics.

Kitchen, C. (2009). *Nonparametric vs Parametric Tests of Location in Biomedical Research.* Los Angeles: UCLA School of Public Health.

Li, W. (2012). *Summary of the Survey on the Service Life of R&D Assets.* Bureau of Economic Analysis.

OECD. (2002). *Frascati Manual.* Paris: OECD Publications.

OECD. (2010). *Handbook on Deriving Capital Measures of Intellectual Property Products.* Paris: OECD Publishing.

OECD. (2001). *Measuring Capital (first edition).* Paris: OECD Publications Service.

OECD. (2009). *Measuring Capital.* Paris: OECD Publishing.

Office for National Statistics, 2008, 'Methods explained: Perpetual Inventory Method (PIM)', Published September 2008 in Economic & Labour Market Review, vol 2, no 9, pp 48–52

Osborne, J. W. (2010). Improving your data transformations: applying the Box-Cox transformation. *Practical Assessment, Research & Evaluation* , 1-9.

Peleg, S. (2008). *Service Lives of Research and Development.* New York: United Nations.

PwC. (2012). *2012 Patent Litigation Study.* Delaware: PwC.

Schumpeter, J. A. (1943). *Capitalism, Socialism, and Democracy.* Taylor & Francis e-Library.

Steer, C., & Ker, D. (2013). *Ownership of R&D Assets.* Newport: Office for National Statistics.

Tanriseven, M., van Rooijen-Horsten, M., & de Haan, M. (2010). *Capitalisation of R&D: Preparing the new ESA.* The Hague: Statistics Netherlands.

United Nations. (2009). *System of National Accounts 2008.* New York: United Nations.

Whittard, D., Franklin, M., Stam, P., & Clayton, T. (2009). *Testing an Extended R&D survey: Interviews with Firms on Innovation Investment and Depreciation.* London: National Endowment for Science Technology and the Arts.

United Nations ECE/CES/GE.20/2014/18

Economic and Social Council

Distr.: General
10 April 2014

English only

Economic Commission for Europe

Conference of European Statisticians

Group of Experts on National Accounts

Thirteenth session
Geneva, 6-9 May 2014
Item 4 of the provisional agenda
Challenges and approaches to the implementation of 2008 SNA

Research and Development: Measurement Issues and the Results of the OECD Survey on Intellectual Property Products

Prepared by the Organisation for Economic Co-operation and Development

Summary

A major methodological development in the 2008 System of National Accounts is the inclusion research and development in the asset boundary. This paper provides the results of the 2012 survey of the Organisation for Economic Co-operation and Development on Intellectual Property Products with a special focus on research and development. It focuses on methodology and measurement practices of the countries of the Organisation for Economic Co-operation and Development and will discuss the major measurement challenges that the countries face. In particular, sharing greater detail on service lives, depreciation rates, and the construction of volume measures may be helpful in the implementation of the 2008 System of National Accounts.

GE.14-21936

1421936

Please recycle

I. Introduction

1. One of the major methodological changes between the 2008 System of National Accounts (SNA) and the 1993 SNA is the expansion of the asset boundary to include research and development (R&D). This is an acknowledgement of the growing importance of the knowledge economy and the recognition that R&D is an important input into the production process; it can be used repeatedly and provides benefits to the owner. As of now, six countries of the Organisation for Economic Co-operation and Development (OECD) (Australia, Canada, Israel, Korea, Mexico, and the United States) have implemented the 2008 SNA and have capitalized R&D in their national accounts. The first section briefly discusses how R&D is typically measured; doing so, some issues related to its measurement are shortly dwelt upon. The second section provides the results of an OECD survey on Intellectual Property Products (IPP).

II. How research and development is typically measured and some measurement issues

2. Most countries use (or will use) the OECD's Frascati Manual (FM) based R&D surveys as a data source for deriving estimates of R&D. The FM-based R&D surveys focus on performers of R&D and collect data on intramural expenditures, that is expenditures on all R&D performed by the statistical unit regardless of the source of funds. Therefore, it is relatively straight-forward to determine where the performance (output) of R&D is taking place. The majority of R&D production is for a firm's own use and therefore it should be recorded as gross fixed capital formation (GFCF) of the firm. However, when the R&D unit is part of a multinational enterprise (MNE) or producing the R&D for sale, the issue of economic ownership and the corresponding use of the R&D may become more difficult to measure. Another issue related to the measurement of R&D is how to derive estimates of consumption of fixed capital (CFC) and the measurement of the capital stock. The following section summarizes the guidance and briefly describes what the countries have done or propose to do in practice.

A. Measuring the Capital Stock and Consumption of Fixed Capital

3. The recommended approach given in the OECD Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2010) is to derive estimates of R&D capital stock using the perpetual inventory method (PIM). The PIM method is the most commonly used method to derive capital stock estimates of fixed assets within the system of national accounts. As such, and confirmed by the OECD survey, most if not all OECD countries will use the PIM to calculate the R&D capital stock. For this, countries need to make assumptions and/or use sources to estimate the service life, the depreciation function and the mortality function for R&D assets.

4. The key approaches on how to estimate service lives as discussed in the R&D literature and the OECD Handbook can broadly be defined as the patent renewal method, econometric methods, survey based approaches, using other countries' assumptions, or a default of an average service life of 10 years. The Eurostat Manual on Research and Development in the European System of Accounts (ESA) 2010[1] makes the following recommendation:

[1] The OECD Handbook on Deriving Capital Measures of Intellectual Property Products includes the output of licenses to use and non-GFCF licenses to reproduce as part of R&D output in order to

"The service life of R&D products should be determined according to evidence from the activities where they are most used as capital assets. Where this evidence is not readily available in Member States, evidence from other Member States with similar industries and R&D products may be used. Where no equivalent Member State and activity can be identified, then general European practice can be followed. As a last resort, where no reliable evidence is available for the activity in which the R&D product is used, a service life of 10 years is acceptable until further information becomes available."

5. In reviewir the responses from the OECD survey, 7 out of 19 countries reported using the default average service life of 10 years as recommended by the Eurostat Task Force on measuring R&D (as well as in the Eurostat manual), because no other information was available. However, some countries stated that additional research was in progress. Of the countries that supplied information of the sources for estimating the service lives or depreciation rates, no single source of information was predominately used by countries. Three countries stated that they conducted surveys or are in the process of conducting a survey. A few countries used information on patents to derive their service life estimates. For the Netherlands, the service life of R&D is based on data on patent amortization and data on patent values. For market sector R&D, the United States argues that "R&D depreciation reflects its declining contribution to a firm's profit as R&D assets become less valuable or obsolete."[2] Therefore, the United States analysed the relationship between investment in R&D and future profits and derived depreciation rates for several R&D intensive industries by using a forward-looking profit model in which each period's R&D investment contributes to the profits in later periods but at a geometrically declining rate.

6. A summary of country responses on service lives and depreciation are shown in the Appendix II.

B. Ownership and use

7. As was discussed earlier, information on R&D expenditures is collected from performers of R&D, which is unlike most types of capital expenditure, for which data are collected from purchasers or users. However, information collected from the FM-based R&D survey normally asks additional questions on sources of funds for the R&D performed and some countries use this information to make the simplifying assumption that the owner of the R&D asset is the funder.[3] Some countries may give special consideration to government funding of R&D through grants which the ownership of the R&D asset may be deemed to remain with the performer.

---

derive the total supply of R&D available for total use and GFCF. The OECD recommendation is consistent with the 2008 SNA in that "The value of the copies made is also recorded as production separately from the production involved in the making of the original." (2008 SNA 6.210) The current version of the Eurostat Manual on Research and Development in ESA 2010 assumes that output arising from sales of licenses to use is, in practice, negligible and, so, actual sales are not included in output, and actual expenditures on license to use or reproduce that satisfy GFCF requirements are not included in GFCF. Countries adopting the simpler Eurostat approach should first attempt to ensure that output by domestic firms does not include revenues from these activities and that imports of R&D do not include related payments.

[2] See "Preview of the 2013 Comprehensive Revision of the National Income and Product Accounts," Survey of Current Business 93 (March 2013) 13-39.

[3] Generally this is likely to be the case where the funder is a market producer but countries are advised to investigate national circumstances in cases where the funder is government and develop the appropriate assumptions. For example, in some countries it may be more appropriate for the recipient of government funds to be classified as the owner.

8. However difficulties can arise when the R&D performer receives a source of funds from overseas especially if it is internal funding within an MNE. The Guide to Measuring Global Production (UNECE, Draft 2014) highlighted that "the funding flows inside MNEs do not necessarily reflect change of ownership of IPPs". Moreover the issue is further complicated by the fact that not all sources of funding, which can include income transfers such as donations and subsidies, can necessarily be hypothecated to the production of R&D.[4] For coherent accounts it is essential that any assumptions made with regard to funding data are consistent with corresponding flows that are (or need to be) recorded in international trade in R&D services statistics. The Task Force on Global Production has highlighted this as an area requiring further research.

9. However, reconciling flows based on Frascati data is only a first step. A perhaps larger issue concerns identifying (economic) ownership from a conceptual perspective. Frascati data will be able to provide an indication of the performer (and funder) but they will not be able to identify subsequent transfers, whether these are made explicitly (and identifiable) in trade in services data or implicit (and often not identifiable at all). And even in cases where transfers are explicit, because MNEs can locate the R&D original asset in an economy that maximizes post-tax MNE profits, many times through Special Purpose Entities (SPEs), it does not necessarily follow that such transfers necessarily align with strict definitions of economic ownership. Establishing who the economic owner is in such cases may not be that easy and straightforward. Determining the economic owner has implications for where the GFCF is recorded and the corresponding treatment of the related flows for the rights to use the R&D, and also, by extension, multifactor productivity estimates. For example, an affiliate in one country may make use of R&D transferred (implicitly, i.e. not recorded in trade in services) to it by its parent. This will, all other things equal, raise the affiliate's production and value-added and also property income payments to the parent, but, because the R&D 'transfer' is not identifiable, the transfer will not be recorded in the affiliate's capital stock estimates (if the entire, or part of the, original is transferred) or trade in services (if only services from using the asset are provided), and, so, productivity of the affiliate will be overstated. Similarly, for the parent, it will appear that no (less) value-added is being generated by its ownership of the R&D asset, which remains on its capital stock at its full value.

10. The Task Force on Global Production in the Guide to Measuring Global Production has grappled with this issue and adopted the pragmatic recommendation that "intra-group transactions are only recorded when data sources point at receipts for IPP use by member units." In other words the Task Force recognises that in practice it will not be possible to impute flows in the absence of any information, and that, as a consequence, productivity estimates will necessarily be affected if transfers are made but not recorded in the accounts. The Guide to Measuring Global Production has a chapter dedicated to the ownership issues related to IPPs as well as guidance on how to determine the economic ownership of IPPs.

[4] See chapter 4, "Ownership of intellectual property products inside global production" in the Guide to Measuring Global Production.

III. Synthesis of the Results of the OECD Survey on Intellectual Property Products[5]

11. At the 2011 OECD Working Party on National Accounts meeting it was discussed that there was a need for sharing greater detail on service lives, depreciation rates and national practices related to Intellectual Property Products (IPPs). The sharing of methodology and measurement practices between OECD-countries in this relatively new area may indeed be helpful in the implementation of the 2008 System of National Accounts (SNA).

12. For the above reasons, the OECD developed and launched a questionnaire on IPPs. The purpose of the questionnaire was to arrive at improved metadata on issues related to country best practice, the availability of data sources, improving understanding measurement of capital stocks and update the current progress related to the implementation of SNA 2008 for specific aspects. Topics covered included Research and Development; Mineral exploration and evaluation; Software and databases; Entertainment, literary and artistic originals; and Other intellectual property products.

13. This note summarises the key issues raised by the 23 OECD countries who responded to the questionnaire (listed in Appendix I) as well as information gathered from country's websites on the implementation of the 2008 SNA. A summary of responses related to service lives is given in Appendix II, and the questionnaire is attached in Appendix III.

A. Research and Development

14. *Expected impact*: There is a wide range of the estimated impact of capitalisation of R&D on gross domestic product (GDP), although there was some uncertainty on the magnitude with some countries noting it would be minimal. Estimates range from 0.5% to 3.5% of GDP with an average of around 1.7% of GDP. Four countries have not yet fully analysed the estimated impact.

15. *Data sources*: A large majority of countries have not needed to use any new surveys, although a few countries have captured the new requirements by revising existing surveys. The main data sources used are specific research and development surveys: e.g. GERD (gross domestic expenditure by government), BERD (gross domestic expenditure by business), and specific surveys for private non-profit bodies. Other data sources include: a) administrative data, e.g. universities and grant information, bank records; b) international trade in services; c) additional surveys, e.g. on structural business statistics, earnings statistics, monthly labour force estimates; d) taxes and subsidies data; e) operating surplus and consumption of fixed capital; f) corporate goods price indices. Where data is not available on a regular annual basis, some countries use a supplementary survey for the years in between by using aggregated estimates from other survey data, administrative data such as tax deductions, or extrapolating for the missing years. One country noted that there was limited coverage for business sector expenditures on social science research.

16. *Methods*: All countries implement, or intend to follow, the methods in both the conclusions of the Eurostat R&D task forces and the OECD manual. For some countries there are still specific outstanding issues. Examples included: a) source limitations making it difficult to collect information about external funds to post graduate students; b) no

[5] This section uses a document prepared by Craig McLaren and presented at the 2012 Working Party Meeting on National Accounts. It was updated with information from country responses as well as country's websites.

information about trade margins, or taxes and subsidies on products and changes in inventories; c) for some countries all expenditures on R&D have been considered as providing a benefit; d) for one country lags are not used, e.g. R&D is registered as an investment in the same period as the production costs occur so there are no changes in inventories; and e) for one country R&D purchases by R&D industries are capitalized in the R&D production account with the primary reason being that there is a lack of information to distinguish single from repeated use and that there is an expectation that single use is small. Where Frascati source data does not exist, some countries use the historical survey data and tax data to estimate the missing part of R&D activities, and/or transform it to the definitions according to the Frascati Manual. This can include adjustment for missing size classes and exhaustiveness.

17. *Double counting*: Nearly all countries take account, or use approaches to minimise, any double counting. Some countries noted that information on this issue was not easily available, but for other countries it was not identified as a significant issue. Different approaches used to estimate double counting included: a) use of information about the number of employees in the software industry, e.g. ratio of software developers to all researchers, comparison of employment data with data on persons employed in R&D at the level of the reporting unit to identify any double counting, or unit record matching; b) the addition of questions, or use of aggregation checks, in the surveys; c) using a historical ratio, or deducting a proportion, e.g. 10% or 50% of user-produced software; d) focus on double counting in particular industries where the issue of double counting is known to be significant, e.g. elements of R&D in oil exploration; e) use of survey information on product fields where all expenditures reported by respondents' as software is excluded.

18. *Sector and industry*: Nearly all countries break down data by institutional sector, although slightly less break down the data by industry. For both sector and industry this is done primarily by the use of the underlying source information, or the allocation of individual units to the different sectors which are subsequently aggregated. Some countries referred to the use of the bridge table approach noted in OECD (2010). Some countries have not yet decided on methods for the sectorial breakdown of private R&D.

19. *Historical data*: For years where estimates do not exist the most common approach is the use of modelling. However, there are a small number of countries who have not decided what approach to use. For some countries, there is additional detail available at a microeconomic level for recent years, but only macroeconomic data for earlier or intermediate years which means for those earlier periods a set of simplifying assumptions, or models, will be used to derive back data. Other approaches included: a) the use of backcasting with a suitably chosen end point, e.g. applying average growth rate of R&D expenditures to historic data; b) use of interpolation or extrapolation based on relative or declining proportions; d) use of a benchmark value and then indicators such as wages and intermediate consumption to construct estimates earlier than the benchmark; and e) use of classification adjustments to align earlier data to earlier collected data.

20. *Capital stock and depreciation*: All countries will, or plan to, use the PIM to calculate capital stock and depreciation. The majority of countries use a geometric depreciation function. Countries that assume the default 10 year service life usually apply a geometric depreciation function, and assume a double-declining balance rate to derive a depreciation rate of 20%. In the case of the United States, only depreciation rates are published; by assuming a double-declining balance rate service life estimates have been derived for cross country comparisons. Mortality functions used included: delayed linear, log normal, Weibull. Service lives differ across countries; see Appendix II for a summary. These can differ based on the type and industry of R&D. For example, 13 years (basic research), 11 years (applied research), 9 years (experimental development), and for specific industries: 7 years (computer programming), 9 years (electronics), and estimates of 15, 20

and 60 years (chemical and pharmaceutical products). Finland and Israel (see Israel, 2008) have calculated detailed service lives for a wide range of industries, ranging from 7 – 10 years, and 5 – 60 years respectively. For all countries, overall service lives used for aggregate R&D were: 4.6 years, 6.2 years, 7 years, 8 years, 10 years, and 12 years. Where service life information was not available, assumptions were based on other countries, or the recommendation by the recent Eurostat taskforce on R&D which notes that "… where such information is not available, a single average service life of 10 years should be retained". Some countries continuing research to derive estimates are Germany, Sweden and the United Kingdom.

21. *Other issues*: Issues raised included: a) an inconsistency between the Balance of Payments and International Position Manual (BPM6) on the one hand and the 2008 SNA on the other hand in the treatment of R&D, where BPM6 incorporates trade in patents in commercial services under R&D services and includes a much broader definition of patented entities than what is defined as R&D fixed assets in the SNA; b) for some countries, a need for clarification of the treatment of R&D by multinational corporations, e.g. is the R&D produced by them mostly exports or domestic investments?; c) integrating into calculations the treatment of consumption of fixed capital used for the production of new R&D results, as it can have an accelerating impact on R&D outputs; d) how to ensure consistency between different data sources, e.g. R&D surveys and structural business surveys; e) choice and sensitivity of the deflation method; and f) how to calculate the cost of capital in the R&D output as it could be sensitive to the choice of calculation.

B. Mineral exploration and evaluation

22. *Data sources*: The majority of countries derive estimates for mineral exploration and evaluation. However, five countries do not estimate this as it is not significant. Different types of data sources used are: a) surveys of the mining industry e.g. quarterly capital expenditure surveys which can capture expenses related to mineral exploration and evaluation; and annual inquiries covering enterprises that have a license for exploring, developing and production activities; b) administrative data from government departments and other industry groups, e.g. geological surveys, or specialised energy organisations; c) financial statements, provision of accounts including information on expenditures on items such as exploratory drilling; d) international trade statistics on exploration services. Proxy information was also used, e.g. revenues and budgets, or turnover figures from the monthly manufacturing reports.

23. *Methods*: Methods used can differ greatly between countries. Broadly, approaches used are: a) use of data directly from specific accounts, surveys or administrative datasets; b) sum of costs approach where costs can be related to development, implementation or expenses paid to others involved; c) the use of telephone interviews made with enterprises and own account workers holding prospecting concessions; d) pro-rating of aggregate estimates based on percentages of sub-components, e.g. exploratory and commercial drilling. One particular example is New Zealand where there is no supply side estimate of mineral exploration, so the demand total is used. In this case the demand data is analysed and verified as part of supply use balancing process.

24. *Capital stock and depreciation*: For those countries that calculate capital stock and depreciation, the PIM is used. Two countries do not calculate capital stock and depreciation for mineral exploration and evaluation. There was an equal use of either geometric or straight line depreciation. The mortality functions used included: simultaneous exit, Weibull, Winfrey curves, log-normal and normal. Service lives used had a wide range from: 1 year, 5 years, 7 years, 10 years, 13 years, 20 years, 30 years, 34 years, to 40 years. Appendix II gives a summary table. Some countries are using the implementation of SNA 2008 to update their assumptions, particularly on the depreciation function.

25. Other issues: Some countries noted that it was very hard to compile reliable statistics for mineral exploration. Particular issues included: a) separating imports from the total costs; and b) having a greater understanding how other countries estimate service lives.

C. Software and databases

26. *Data sources*: All responding countries currently compile, or have plans to derive, estimates for software. However, for some countries it was difficult to separately estimate databases from software. There was a wide range of data sources reported with sources different based on different types of software and databases. Some countries use specific surveys on Information and Communication Technology, e.g. capturing sales to known end-users and other sales, and distinguishing between published software and IT services. In some examples a particular sampling frame was constructed based on IT related occupations. Other examples of data sources are: a) labour force surveys on employment and earnings, wages and salaries, including hours worked on development of own-account software and database creation; census information; industry production of commodities; investment surveys; b) data related to balance of payments statistics, e.g. import and exports, trade margins of software from imported goods; household expenditure; capital expenditure, including the value of expenditure on computer software and databases; input-output tables; c) public sector estimates, e.g. survey information and local and central government financial statements; central government income and outlays; d) financial statements, administrative records such as annual accounts, reports from central banks or tax authorities; or those from trade associations and specialised journals. Where data sources or historical data do not exist, modelling is used. Some countries are planning to enhance their data sources to separate out the collection of database information.

27. *Methods*: Methods can differ greatly between countries and can also be complex. In practice, some countries noted that it was difficult to separate database estimates. Broad descriptions of approaches used are: a) use of data directly from either industry specific surveys on Information and Communication Technology or administrative data such as customs or tax records for software licenses. b) production cost method, where labour and non-labour costs are estimated, e.g. using data from the labour force survey for the particular industry such as wages, working hours, number of employees; c) use of ratios, e.g. labour costs associated with the production of own-account software; d) use of a commodity flow framework, e.g. use of input-output tables; or a supply and demand residual approach. One example is used by Canada which estimates components of the software market, with investment determined as the amount that equates demand with supply. The supply consists of domestic production, plus imports, plus the wholesale, retail and tax margins on software sales. Investment in software is then determined as the amount that equates demand to supply. Details on methods used in Canada, Czech Republic, Germany and Sweden methods are included in the references.

28. *Sector and industry*: The majority of countries can create estimates by both sector and industry, although some countries could not create estimates for sectors but could for industry. For the majority of countries, the breakdown of data by sector and industry can be achieved because the source data, survey or administrative, is collected in this way. Specific approaches for sectors include: a) using government accounts to derive purchased software in the government sector; b) for own-account software, the breakdown by institutional sector is derived from the production structure of the different industries; c) using certain industries as a proxy; d) use of shares of production, models or ratios based on input-output tables; d) a bottom up approach based on the individual source data and unit industry information. Specific approaches for industries include: a) the use of labour force survey data, or salary estimates, to estimate investment at an industry level for own account software investment; b) use of specific questionnaires for purchased software, c) a bottom up approach based on the individual source data and unit industry information; e) use of

industrial information from the input-output tables; and e) use of industry proportions from survey data. For countries where the source data coverage is not adequate they mentioned that they will expand the coverage, e.g. for purchased software.

29. *Capital stock and depreciation*: All countries use the PIM to calculate capital stock and consumption of fixed capital, although the depreciation assumptions differ between countries. There was a slight preference for the use of linear depreciation over geometric deprecation. Different mortality functions included: delayed linear, normal, truncated normal, log-normal, Winfrey, and Weibull. Service lives reported included: 3 years, 3.7 years, 4 years, 4.5 years, 5 years, 10 years, and in one country the service life is the same as the one for computer equipment. Some countries use different service lives for different groups. For example, Denmark: 4 years for software purchases, 6 years for own account; Germany noted that software for mainframes had a longer service life with 10 years compared to 5 years for desktop software (see Schmalwasser and Schidlowski, 2007); Israel use 4 years for imported pre-packaged software, and 5 years for own-account and customised software; Sweden use a service life of 5 years for purchased software and 10 years for own developed software and databases. In some countries there were no estimates of service lives based on directly observed data. In this case guidance was used based on administrative sources and recommendations from OECD manuals Measuring Capital (2001 and 2009) and previous task forces. Appendix II gives a summary of depreciation information.

30. *Other issues*: Issues were raised in that it was difficult in practice to separate databases from software, and even with the existing guidance and previous task forces, the quality of the estimates (for some countries) could still be improved. Other aspects were: a) how to distinguish between databases which are fixed assets and those that are not; and b) the distinction between regular maintenance and software maintenance work to be considered as investment.

D. Entertainment, literary and artistic originals

31. *Data sources*: The majority of countries who responded compile estimates for entertainment, literary and artistic originals. There were five countries who currently do not collect, or plan to collect, this information. A wide range of data sources are used in practice. These include: industry specific administrative data about royalties, royalty flows and distribution of royalties; broadcasting companies reports, including reports from specific copyright societies for authors, composers and musicians; surveys on production costs, or income. For originals without an established system of royalty flows (e.g. films, TV, radio productions and literary originals) a production cost approach can be used. Alternatives are the use of administrative data, e.g. tax data which can include performance fees, data direct from TV broadcasters, reports from patent and trademark offices. Some countries have no direct information available from surveys or administrative data. In this case indirect estimates were obtained by using foreign trade in services, household budget surveys; and the use of turnover statistics. Some countries noted that that due to the lack of available and reliable data, external experts outside of the National Statistics Institute were being used to assist in obtaining improved estimates, e.g. liaising with patent offices and academics.

32. *Methods*: As expected, methods differ greatly between countries and between the different assets. They can also be quite complex. Broad examples of approaches are: a) cost based valuation methods directly from data sources, e.g. income, purchases of programmes, data on payments, commissioned works, royalties, tax data; b) production cost method with a correction for operating surplus, e.g. by estimating labour and non-labour costs; c) use of the value of royalties received as a proxy for the value of originals created; estimation methods based on taking the discounted net present value of future receipts; d) use of

payments to domestic beneficiaries, payments to and from foreign companies; e) commodity flow methods; f) use of linear interpolations when data is not available; or g) modelling relationships using data such as expenses, royalties or interest rates.

33. *Sector and industry*: The majority of countries can create estimates by both sector and industry. For the majority of countries, the breakdown of data by sector and industry can be achieved because the source data is collected in this way. As only particular sectors are impacted, it is easier to allocate. Examples of approaches are: a) estimates on films, TV and radio stock programmes allocated to non-financial corporations, while literary works are allocated to the household sector; b) entertainment and literature allocated to non-financial corporations, while music is divided between households and non-financial corporations; c) use of proxy information such as shares of production costs, relative share in employment, editorial costs and royalties can be used to allocate to sector (and industry); d) a bottom up approach based on the individual source data and unit industry information. Regarding the allocation to industries, for the cases where aggregated data is available, the division between the type of original and the related industries is obvious, e.g. investments in originals occur only for select industries. Examples of approaches are: a) use of different type of royalties as a proxy to allocate the total to industries; b) classification of activity according to the type of organisation which is receiving the compensation; c) a bottom up approach based on the individual source data and unit industry information.

34. *Capital stock and depreciation*: All countries use the PIM to calculate capital stock and consumption of fixed capital, although the depreciation assumptions differ between countries. Countries generally used the same assumptions for entertainment, literary and artistic originals. Across countries typically either the linear or geometric depreciation was used. A wide range of different mortality functions were used including: linear, normal distribution, Winfrey curves, log normal and the gamma distribution. Service lives reported were: 3 years, 5 years, 7 years, 10 years, and 13 years. In a majority of cases it was noted that there was no supporting evidence for using these service lives. However, some countries referred to the recommendations from the GNP Committee on Entertainment, Literary and Artistic Originals which recommends a service life of between 5 to 10 years (OECD, 2010, page 163). The Netherlands use different service life assumptions for different assets, e.g. for originals: service life of 5 years, and for royalties a service life of 10 years. While Germany estimated average service lives on the basis of differentiated information on motion pictures, TV productions, sound storage media, music compositions, artistic performances and texts (Schmalwasser and Schidlowski, 2007). Appendix II gives a summary table of depreciation information.

35. *Issues*: Particular issues mentioned included: a) the need to improve the coverage of the computer gaming industry; b) the treatment of data from special purpose entities that focus on royalty and licensing; and c) using the introduction of SNA 2008 / ESA 2010 as an opportunity to introduce revisions, e.g. through improving specific data sources to increase coverage of activity abroad, changing depreciation assumptions and including additional outputs.

E. Other intellectual property products

36. Only two countries mentioned the availability or collection of Other Intellectual Property Products. For example, The Netherlands produce a separate knowledge satellite account outside the main National Accounts estimates. Their satellite account includes: investment in architectural and engineering designs, firm-specific human capital, organisational structures, and brand equity. Similarly, Slovenia noted the availability of documentation related to the design and construction of infrastructure projects, such as expert reports, blueprints and feasibility studies.

IV. Summary and way forward

37. It can be seen from those countries that estimate a unique service life of R&D by industry that there is a reasonable degree of variation across industries. It can especially be seen on the one hand in the service life assumptions of the semiconductor, electronics, and computer industries where there are shorter service lives (5 – 8 years) and on the other hand in the longer service life assumptions of the pharmaceutical and chemical manufacturing industries (varying from 12 to 60 years). The results indicate that some care is needed in applying the 10 year rule of thumb suggested by the Eurostat task force, particularly when the focus is on comparisons of multi-factor productivity across countries and industries.

38. Notwithstanding these issues however it is clear that significant challenges remain. Chief amongst these is the issue of ownership within MNEs, where research continues.

V. References

Australia (2009) Implementation of New International Statistical Standards in ABS National and International Accounts http://www.abs.gov.au/ausstats/abs@.nsf/Products/5310.0.55.002~September+2009~Main+Features~Chapter+6%20Research+&+Development?OpenDocument

Canada (2001) http://www.statcan.gc.ca/pub/13-605-x/2003001/concept/2001software-2001logiciel/index-eng.htm

Czech Republic (2002) GNI Inventory, Link: http://apl.czso.cz/nufile/GNI_CZ_en.pdf

Germany (2009) "Gross Domestic Product in Germany in accordance with ESA 1995. Methods and sources", Link: https://www.destatis.de/DE/Publikationen/Thematisch/VolkswirtschaftlicheGesamtrechnungen/Inlandsprodukt/GrossDomesticProduct6489022059004.pdf?__blob=publicationFile

Israel, 2008, Service lives of Research and Development, Link: http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.20/2008/sp.3.e.pdf

OECD, 2010, Handbook on Deriving Capital Measures of Intellectual Property Products, Link: http://www.oecd-ilibrary.org/economics/handbook-on-deriving-capital-measures-of-intellectual-property-products_9789264079205-en

OECD, September 2012, Internal documents. Country responses to questionnaire on Intellectual Property Products.

Schmalwasser, O., and Schidlowski, M. (2007) Measuring Capital Stock in Germany, Link: https://www.destatis.de/EN/Publications/Specialized/Nationalaccounts/MeasuringCapitalStockWista1106.pdf

Sweden (2009) GNI Inventory, page 202-2009, Link: http://www.scb.se/Statistik/NR/NR0102/_documents/ESA95%20GNI%20INVENTORY.pdf

United Nations Economic Commission for Europe (2014) Guide to Measuring Global Production: http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.20/2014/Guide_to_Measuring_Global_Production_-_CES.pdf

United States BEA Depreciation Estimates: http://www.bea.gov/national/pdf/BEA_depreciation_rates.pdf

United States, BEA, Preview of the 2013 Comprehensive Revision of the National Income and Product Accounts," Survey of Current Business 93 (March 2013) 13-39.

Appendix I: Responding countries

The following country responses formed the basis of this document: Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, Germany, Hungary, Ireland, Israel, Italy, Japan, The Netherlands, New Zealand, Norway, Portugal, Russia, Slovak Republic, Slovenia, Sweden, United Kingdom, and United States.

Appendix II: Summary of depreciation information

The following tables summarise depreciation information based on country responses to this survey.

Country	*Method*	*Service life*	*Depreciation function*	*Mortality function*	*Source*
Australia[1]		11 years			patent information
Austria	PIM	13 years (basic research) 11 years (applied research) 9 years (experimental development)	Geometric	Delayed linear	Other country
Belgium	PIM	10 years*	Geometric		Eurostat Task Force
Canada	PIM	6.2 years	Geometric		
Czech Republic	PIM	8 years	Linear	Log-normal	
Denmark	PIM	Most likely breakdown between basic research, applied research, and experimental development	Geometric		
Finland	PIM	For market sector: Detailed information available by industry: All industries are 10 years, except: (1) Computer programming and information service activities (NACE rev. 2 62-63): 7 years (2) Chemical and pharmaceutical manufacturing (NACE rev. 2 20-21): 20 years For non-market sector: 10 years	Geometric		International experience, patents, and discussions with selected corporations
Germany	PIM	Survey in progress; alternative is 10 years*			Eurostat Task Force Survey in progress
Ireland	PIM	Work in progress			
Finland	PIM	For market sector: Detailed information available by industry: All industries are 10 years, except: (1) Computer programming and information service activities (NACE rev. 2 62-63): 7 years (2) Chemical and pharmaceutical manufacturing (NACE rev. 2 20-21): 20 years For non-market sector: 10 years	Geometric		International experience, patents, and discussions with selected corporations

Country	*Method*	*Service life*	*Depreciation function*	*Mortality function*	*Source*
Germany	PIM	Survey in progress; alternative is 10 years*			Eurostat Task Force Survey in progress
Ireland	PIM	Work in progress			
Israel[2]	PIM	Pharmaceutical: 13 (minor develop) or 21 years (major develop) Chemical: 12 (minor develop) or 60 years (major develop) Semiconductors:5, 8, or 13 years depending on use Monitoring equipment: 13 (develop on existing product) or 20 years (original) Software: 5 (minor) or 9 years (major) Fabricated metal products except machinery & equipment: 12 (minor) or 18 years (major)	Linear	Truncated normal	Pilot Survey
Italy	PIM	10 years*	Geometric		Eurostat Task Force
The Netherlands	PIM	All industries (except chemical and electronics): 12 years Chemical: 15 years Electronics: 9 years	Winfrey	Weibull	Data on patent amortization and data on patent values
New Zealand	PIM	Still need to consider			
Norway	PIM	10 years*			Eurostat Task Force
Portugal	PIM	10 years*	Linear	Delayed linear	Eurostat Task Force
Slovak Republic	PIM				
Slovenia	PIM	10 years*	Geometric		Eurostat Task Force
Sweden	PIM	10 years*; additional work in progress			Eurostat Task Force
United Kingdom	PIM	4.6 years	Geometric	Weibull	Pilot Survey

Country	*Method*	*Service life*	*Depreciation function*	*Mortality function*	*Source*
United States[3]	PIM	**Market Sector:** **Manufacturing-** Pharmaceutical: 20 years Chemical: 12.5 years Semiconductor: 8 years Computer & peripheral equipment: 5 years Other computer and electronic: 5 years Communications equipment: 7.4 years Navigational, measuring, electro medical: 6.9 years Motor vehicles:6.5 years Aerospace: 9.1 years Other manufacturing: 12.5 **Nonmanufacturing-** Scientific research and development services: 12.5 years Software publishers: 9.1 years Financial and real estate services: 12.5 years Computer systems design: 5.6 years All other nonmanufacturing: 12.5 years **Nonmarket sector:** University & colleges: 12.5 years Other non-profits: 12.5 years Federal government defence extramural R&D: 10.1 years Federal government defence intramural R&D: 12.5 years Federal government nondefense: NASA: 27.7 years Health: 22.1 years Energy: 21.4 years Transportation: 12.5 years Other federal nondefense: 12.5 years State and local R&D: 12.5 years	Geometric		**For market sector**: Model that relates R&D GFCF to firm sales & profitability. Analysis done using firm-level and establishment-level data. **For non-profits**: based on estimates of business depreciation (scientific research and development services) **For federal government national defence extramural, NASA, Health, and Energy**: BEA research based on a progression of R&D investments by function that led to observable outcomes, such as investments in stealth technology that resulted in the development of particular military aircraft. **For other federal government and state and local government**: based on estimates of business depreciation (scientific research and development services)

* RECOMMENDATION FROM A EUROSTAT TASK FORCE: "IN CASE, WHERE SUCH INFORMATION IS NOT AVAILABLE, A SINGLE AVERAGE SERVICE LIFE OF 10 YEARS SHOULD BE RETAINED"

1. SOURCE: HTTP://WWW.ABS.GOV.AU/AUSSTATS/ABS@.NSF/PRODUCTS/5310.0.55.002~SEPTEMBER+2009~MAIN+FEATURES~CHAPTER+6%20RESEARCH+&+DEVELOPMENT?OPENDOCUMENT

2. SOURCE: HTTP://WWW.UNECE.ORG/FILEADMIN/DAM/STATS/DOCUMENTS/ECE/CES/GE.20/2008/SP.3.E.PDF

3. ASSUMES A DOUBLE DECLINING BALANCE RATE TO CALCULATE SERVICE LIFE; SOURCE: HTTP://WWW.BEA.GOV/NATIONAL/PDF/BEA_DEPRECIATION_RATES.PDF

Appendix III: Questionnaire sent to countries

1. Research and Development

a) What is the expected impact of capitalisation of R&D on GDP?

b) What data sources have you used to compile estimates of R&D? (e.g. list any surveys or administrative data that you have used including coverage and frequency)

c) The OECD Handbook on Deriving Capital Measures for Intellectual Property Products manual provides guidance on deriving estimates for R&D. Briefly describe the methods you have used for deriving estimates for R&D. (e.g. how closely have you followed the manual, and in particular the links to Frascati data, or if you have used alternative approaches)

d) Have you made allowances for the treatment of software in R&D to avoid double counting? (e.g. yes, no, do not know). If yes, briefly described the methods used.

e) Have you created estimates of investment in R&D broken down by institutional sector? If yes, briefly describe the methods used. Please describe whether the sources and methods differ depending on the sector being covered.

f) Have you created estimates of investment in R&D broken down by industrial activity? If yes, briefly describe the methods used. Please describe whether the sources and methods differ depending on the industrial activity being covered.

g) How will you create historic estimates of investment in R&D? (e.g. by modelling)

h) What method(s) do you use to calculate capital stock and depreciation? Are they consistent with each other? (e.g. PIM, description of alternative method, none).

i) Please describe the main assumptions you use to estimate depreciation: e.g. service lives, depreciation functions, retirement patterns. Please attach data if it is available. (e g. for service lives broken down between average time of development, average time between end of development and start of use in production/operation, average time from start of use in production until end of use). Please also specify whether the assumptions differ depending on the industry.

j) Do you have any other comments on issues related to measuring R&D?

2. Mineral exploration and evaluation

a) Do you compile estimates for mineral exploration and evaluation?

If yes, what data sources have you used to compile estimates? (e.g. list any surveys or administrative data that you have used including coverage and frequency)

b) Briefly describe (or attach, reference) the methods you have used to derive estimates of mineral exploration and evaluation

c) What method(s) do you use to calculate capital stock and depreciation? (e.g. PIM, description of alternative method, none)

d) Please describe the main assumptions you use to estimate depreciation: e.g. service lives, depreciation functions, retirement patterns. Please attach data if it is available.

e) Do you have any other comments on issues related to measuring Mineral exploration and evaluation?

3. Software and databases

a) Do you compile estimates for software and databases?

If yes, what data sources have you used to compile estimates? (e.g. list any surveys or administrative data that you have used including coverage and frequency)

b) Briefly describe (or attach, reference) the methods you have used to derive estimates of software and databases.

c) Have you created estimates of investment in software broken down by institutional sector?

If yes, briefly describe the methods used. Please describe whether the sources and methods differ depending on the sector being covered.

d) Have you created estimates of investment in software broken down by industrial activity? (e.g. yes, no, unknown)

If yes, briefly describe the methods used. Please describe whether the sources and methods differ depending on the industrial sector being covered.

e) What method(s) do you use to calculate capital stock and depreciation? (e.g. PIM, description of alternative method, none)

f) Please describe the main assumptions you use to estimate depreciation: e.g. service lives, depreciation functions, retirement patterns. Please attach data if it is available.

g) Do you have any other comments on issues related to measuring software and databases?

4. Entertainment, literary and artistic originals

a) Do you compile estimates for entertainment, literary and artistic originals?

If yes, what data sources have you used to compile estimates? (e.g. list any surveys or administrative data that you have used including coverage and frequency)

b) Briefly describe (or attach, reference) the methods you have used to derive estimates of entertainment, literary and artistic originals (e.g. including the coverage and treatment of Films, TV and radio stock programmes, literary works, and musical works)

c) Have you created estimates of investment in entertainment, literary and artistic originals broken down by institutional sector?

If yes, briefly describe the methods used. Please describe whether the sources and methods differ depending on the sector being covered.

d) Have you created estimates of investment in entertainment, literary and artistic originals broken down by industrial activity?

If yes, briefly describe the methods used. Please describe whether the sources and methods differ depending on the industrial sector being covered.

e) What method(s) do you use to calculate capital stock and depreciation? (e.g. PIM, description of alternative method, none)

f) Please describe the main assumptions you use to estimate depreciation: e.g. service lives, depreciation functions, retirement patterns. Please attach data if it is available.

g) Do you have any other comments on issues related to measuring entertainment, literary and artistic originals?

5. Other Intellectual Property Products

a) Are there any other Intellectual Property Products that you include in your National Accounts estimates. Please list them below.

United Nations ECE/CES/GE.20/2014/19

Economic and Social Council

Distr.: General
25 March 2014

English
English and Russian only

Economic Commission for Europe

Conference of European Statisticians

Group of Experts on National Accounts

Thirteenth session
Geneva, 6 -9 May 2014
Agenda item 2
Progress with national implementation plans for the System of National Accounts

Plans, priorities and challenges faced in implementing SNA 2008 in Belarus

Prepared by National Statistical Committee of the Republic of Belarus

Summary

The paper provides information on the current status of national accounts in the Republic of Belarus, the main issues and challenges arising during the implementation of the updated System of National Accounts, 2008 (2008 SNA). It focuses in more detail on main areas of work and the progress made in implementing 2008 SNA – estimation of financial intermediation services indirectly measured (FIS!M), implementation of new approaches to include expenditures on R&D and armament systems. The paper also outlines specific directions of further work on improvement of the national accounts of Belarus.

GE.14-21491

1421491

Please recycle

I. Introduction

A. Current state of national accounts in Belarus

1. The implementation of the System of National Accounts in the statistical practice of Belarus in consistency with all requirements of the international standards began in 1993.

2. The national accounts of the country are currently compiled on the basis of methodological principles of the System of National Accounts 1993 standard (SNA 1993). Out of accounts recommended for the compilation of SNA 1993 in Belarus the following current accounts have been constructed since 1990: the production account, the generation of income account, the primary distribution of income account, the secondary distribution of income account, the redistribution of income in kind account, and the use of disposable income account.

3. All accounts are compiled and published for resident units by five sectors of the economy; transactions between residents and non-residents are reflected in the 'rest of the world' sector. The production account and generation of income account are also compiled by economic activity.

4. Accumulation accounts are represented by the capital account.

5. It should be noted that starting from January 2011 all SNA estimates have been made in a breakdown by economic activity. The Nationwide Classification of Economic Activities (OKED) is compatible with the International Standard Industrial Classification of All Economic Activities (ISIC) at 4-digit level. Moreover, the time series of macroeconomic indicators of production accounts at current and constant prices and of income accounts at current prices have been built backward to 2000.

6. Selected indicators of the System of National Accounts are calculated using the Nationwide Classification of Industrial and Agricultural Products of the Republic of Belarus which is compatible with the Statistical Classification of Products by Activity at 4-digit level.

7. The Classification of Individual Consumption According to Purpose (COICOP) is used in the household survey, and thus for the calculation of household final consumption expenditure.

8. Data on budget spending are classified according to the Classification of the Functions of Government (COFOG).

9. In 2003 we commenced the work on compiling input-output tables in compliance with the methodological principles and standards of the SNA 1993. The system of input-output tables was previously compiled in accordance with the All-Union Classification of Branches of National Economy – by 17 branches of the economy and 14 subindustries; starting from 2011 the tables have been compiled by economic activities in accordance with OKED.

10. Today we compile the following set of tables: the supply and use tables at purchasers' prices; the use table at constant prices; the trade and transport margin tables; the taxes less subsidies on products table; and the imports use table.

11. To analyse regional policies, in October 2008 we started to estimate the gross regional product (GRP); until 2011 GRP was estimated experimentally by production approach, and from 2011 these estimates have been published officialiy. The methodological principles of estimating GRP and its components at the regional level are

similar to the principles of measuring these indicators at the level of the economy as a whole.

B. Priority directions in implementing the SNA 2008 and issues which were not resolved in the process of the implementation of the SNA 1993

12. To introduce the updates SNA 2008 standard, a programme of the SNA 2008 implementation has been elaborated within the framework of the national Strategy for the Development of State Statistics. The national Strategy and the programme of the SNA 2008 implementation specify the main stages such as adaptation of the classification systems, set priorities for the major unresolved issues of the SNA 1993, and outline the principal provisions of the SNA 2008 recommended for implementation.

13. In order to improve the quality of national accounts and to implement successfully the SNA 2008 it is essential that other producers of economic statistics such as the National Bank, the Ministry of Finance and some other ministries and agencies are involved in the process.

14. In August 2013 a working group on the implementation of the main SNA 2008 provision in the statistical practice was set up and approved by the order of Belstat, and an action plan for the SNA 2008 implementation was adopted. The working group consists of the representatives of the Ministry of Economy, Ministry of Finance, National Bank, Ministry of Defense, Ministry of Natural Resources, State Committee on Science and Technology, State Customs Committee as well as the representatives of the Research Institute of Economy of the Ministry of Economy of the Republic of Belarus.

15. The activities of the working group build upon the collaborative interaction between the agencies for resolving methodological issues and data provision in consistency with the SNA 2008.

16. The Strategy for the Development of State Statistics for 2011-2017 the activities planned for the implementation of the main provisions of the SNA 2008 in the statistical practice.

17. As mentioned before, to implement successfully the activities for introducing the SNA 2008 we should bear in mind the current state of the SNA 1993 implementation.

18. At present the following accounts are not compiled in Belarus: the financial account, the other changes in the volume of assets account, the revaluation account, and balance sheets.

19. On the basis of the monetary tables of the National Bank of the Republic of Belarus experimental estimates of domestic and external financing are produced for the economy as a whole and by sectors, but so far these instruments do not allow for the complete verification of current accounts and the capital account.

20. Within the framework of the Strategy for the Development of State Statistics until 2017 we are planning to implement jointly with the National Bank the activities for the integration of the financial account in the system of national accounts.

21. The balance sheets have not been compiled so far because of the lack of the estimated current market value of non-produced assets.

22. The activities for constructing balance sheets have been carried out according to the Plan as specified in the Strategy for the Development of State Statistics until 2017. In 2012, additionally reviewing this issue, we addressed the Ministry of Natural Resources and Environmental Protection, Ministry of Forestry, Ministry of Agriculture and State

Committee on Property of the Republic of Belarus asking about the possibility of receiving the data (in value terms) on the availability of and changes in selected natural resources (land; mineral and energy resources; uncultivated biological resources related to flora and fauna; water resources; and other natural resources). At present these agencies do not have the required data, and various types of natural resources are recorded in physical terms (quantitative and qualitative characteristics) within the framework of balance sheets and cadastres.

23. The State Committee on Property has the information on the cadastre value of land of localities, horticultural societies and dacha cooperatives as of the different dates of its appraisal. Agricultural land of agricultural organisations and individual farm holdings is valued in grades of cadastral valuation, i.e. the monetary value of this type of land is lacking.

24. The Ministry of Finance has also faced difficulties in compiling and disseminating government finance statistics (GFS) for the submission to the International Monetary Fund. It is impossible to reflect the value of state-owned land, natural resources, the value of subsoil resources, minerals, and the market value of other fixed assets of the country.

25. Belstat and the Ministry of Finance jointly prepared a letter asking to consider this issue; respective instructions were given to ministries and agencies responsible for the provision of this information.

26. Fiscal reporting is compiled in the country using classifications which are generally consistent with the Government Finance Statistics Manual (GFSM) 2011.

27. The important difference between the Government Finance Statistics (GFS) and the budgetary accounting of Belarus is related to the principles of transaction evaluation. So, GFS recommends to record transactions on an accrual basis. In our accounting transactions are recorded with a cash method.

28. Data for the government sector are currently not compiled within the budgetary accounting of Belarus. However, in the near term data on public corporations which are the most significant in terms of the mutual transactions with the budget are planned to be included in the GFS for the government sector.

29. Improvement of the preparation and presenting of the GFS data in compliance with the requirements of the international standards will allow for the use of these data in macroeconomic policy-making and compilation of the government sector in national accounts.

30. Within the framework of the Strategy for the Development of State Statistics until 2017 work is carried out to improve the compilation of the System of National Accounts in the country and to gradually implement the main provisions of the SNA 2008.

31. The main areas of the national accounts improvement for Belarus as well as for the majority of the CIS countries are changes affecting the GDP value, structure and growth rates elaborated with the involvement of international organisations.

32. The action plan of the country is aimed at the improvement of the quality of national accounts and implementation of the major changes and revisions of the SNA 2008 which more and more attract the attention of analysts and can be introduced in Belarus.

33. At present, according to the SNA 1993 the financial intermediation services indirectly measured (FISIM) are classified as an individual economic activity and are estimated indirectly as a difference between the interest on credits and other instruments placed by banks to residents and non-residents, and interest paid on deposits and other funds-attracting bank instruments.

34. The SNA 2008 recommends using the methods of FISIM accounting only in relation to loans and deposits and only in that cases when these loans are provided by financial institutions and deposits are placed in financial institutions.

35. As a result of the joint work of the National Bank and Belstat we received the information separately on credits and deposits in national and foreign currency for institutional sectors of the economy in monthly time series.

36. Based on these data, we calculated the basic rate as a ratio of the sum of interest paid out and received to the total volume of credits and deposits for the economy as a whole and for each institutional sector. FISIM was estimated in compliance with the SNA 2008 formula (rL-rr)yL+(rr-rD)*yD[1].

37. The basic rate was estimated taking into account interbank rates, the highest bank rates of deposits, the lowest rates on credit, and rates on long-term government bonds; at the same time the basic rate had to be between the rates on credit and deposits.

38. Using the basic rates for each sector has led to the discrepancy between the sum of FISIMs by sector and the total FISIM calculated at the level of the economy.

39. Within the framework of the activities of the joint working group for the implementation of the SNA 2008 in the statistical practice consultations were held with the specialists of the National Bank, and additional information for adjusting the total volume of credits for the credits extended under credit rates below the market rates was provided.

40. By using the share of residential loans extended to households in the total volume of credit, FISIM has been broken down into final and intermediate consumption. By using the data of financial reports on interest received on deposits and paid out on credits, the intermediate consumption of FISIM has been distributed by industries.

41. At the moment experimental estimates for the years 2011-2012 have already been made and we are now in the process of estimating FISIM for 2013 and distributing it by sectors and economic activities. According to the results of these estimates the value of FISIM has decreased, consequently the GDP for these years will be higher.

42. At present the issue of estimating FISIM at constant prices has to be considered closely.

43. The next most important for the country from the point of view of their impact on the volume and structure of GDP are changes in the treatment of research expenditure and reflecting military expenditure.

44. Even now there is a statistical survey the results of which are used for the compilation of data on the commercialisation of results of scientific and technological activities in compliance with the Frascati Manual, on the sales of research and experimental development services as well as the data on general government sector. The survey covers all sectors which incur R&D expenditure.

45. After reviewing the obtained data on R&D expenditure and after the consultation with a representative of the State Committee on Science and Technology it has become evident that using the information on commercialisation on the basis of data from the statistical survey in the calculation of the SNA estimates is challenging because most research projects are implemented longer than one year, and data on commercialisation are reflected after a project is completely finalised.

[1] rL- credit interest rate; rr – basic rate; rD – deposit interest rate; yL – volume of credits; yD – volume of deposits.

46. We are currently in the process of disaggregating the survey data into three groups – market producers engaged in sales; market producers not engaged in sales (R&D activities are funded by themselves); and general government sector units – and comparing the data, which would allow for measuring the output, intermediate consumption and gross fixed capital formation. As a result, GDP is expected to show an increase.

47. The SNA 2008 recommends to classify weapon systems as fixed assets, and this classification should be based on the same criteria as for other fixed assets, meaning these are produced assets which are used repeatedly or continuously in the process of production for more than one year.

48. Single-use objects, such as ammunition supplies, missiles, bombs and the like delivered with the aid on weapon systems are considered as the military inventories. At the same time, some single-use items may ensure a permanent service of deterrence of aggressors, and thus can comply with the general criteria to be classified as fixed assets.

49. To solve this issue, the cooperation with the Ministry of Defence was needed. The working group on the SNA 2008 implementation discussed the question concerning the expenditure on weapon systems which are continuously used for the production of defence services. The next issue was about the consumption of fixed capital.

50. An agreement was reached on the provision of annual data on the expenditure on armament systems, on the quantity and costs of assets in the year of their purchase and their service life. But because this information is confidential, an additional agreement on the receiving of such information and its use for the calculation of national accounts indicators is required.

51. Also, for the improvement of national accounts statistics we have made experimental estimates of imputed rent by 'user-cost approach'. According to this approach the volume of housing services is estimated as a sum of all costs – of intermediate consumption, other taxes on production, consumption of fixed assets and net operating surplus.

52. We have already received experimental estimates of imputed rent of owner-occupied dwellings by user-cost approach for 2008-2012 and quarterly estimates for 2010-2012. The GDP changes will show an increase. However, the sources of data on land valuation under dwellings need to be reviewed.

53. It should further be mentioned that the National Bank of the Republic of Belarus carries out estimates in accordance with the 6th edition of the Balance of Payments Manual and within exports and imports reflects only the service of processing goods sent for processing abroad. Within the framework of the improvement of the SNA indicators the transactions with goods sent for processing abroad will be reflected in compliance with the SNA 2008.

C. Development prospects

54. Starting from January 2016 a new version of the classification of economic activities OKED 005-2011 will be introduced in the statistical practice of Belarus. This version is based on the classification of economic activities of the European Union NACE, rev. 2.0.

55. Taking into account emerging of new business patterns on the market and changes in the classification of institutional units, the national accounts indicators by sectors and subsectors will be compiled according to the SNA 2008.

56. Because the SNA 2008 includes the chapter on informal economy, and its aim is to ensure the full coverage of all economic activities in the SNA and to distinguish the

activities of informal sector within the household sector which is of interest for economic policy making, and also because the informal sector provides for a part of production in the country, the Strategy for the Development of State Statistics until 2017 includes certain activities for the improvement of the non-observed economy estimates.

57. In March 2014 a working group on the improvement of the non-observed economy estimates was established. The group includes subject-matter statisticians of Belstat and researchers.

58. Because we currently estimate the activities of insurance organisations on a consolidated basis, without singling out of reinsurer services, and in the SNA 2008 transactions between an insurer and reinsurer should be valued as a separate set of transactions, reinsurer services should be in future included in the intermediate consumption of the direct insurer.

59. It should be mentioned that the GDP time series revised on the basis of the experimental estimates in compliance with the SNA 2008 and the new OKED version will be published from 2010. The GDP estimates with account of the adopted improvements are planned to be made as from the quarters of 2016.

United Nations ECE/CES/GE.20/2014/20

Economic and Social Council

Distr.: General
2 April 2014

English only

Economic Commission for Europe

Conference of European Statisticians

Group of Experts on National Accounts

Thirteenth session
Geneva, 6 -9 May 2014
Agenda item 7
Globalization and national accounts: accounting for global production

Compiling trade in goods and services statistics of Hong Kong using the change of ownership principle

Prepared by the Census and Statistics Department of Hong Kong, Hong Kong Special Administrative Region, China

Summary

Hong Kong SAR, China has implemented the change in ownership principle in compiling statistics on goods sent abroad for processing and merchanting since 2012. Data are backcasted to earlier periods where such global production activities were notable. Their experience and challenges in measuring the activities in line with 2008 System of National Accounts and Balance of Payments Manual, 6th edition, are outlined in this paper.

GE.14-21677

1421677

Please recycle

I. Introduction

1. In the Sixth Edition of the Balance of Payments and International Investment Position Manual (BPM6) and System of National Accounts 2008 (2008 SNA), the change of ownership principle is recommended for recording goods sent aboard for processing and merchanting. Implementing this principle will have significant impact on the trade in goods and services statistics of economies that engage in substantial amount of processing trade and merchanting activities. Hong Kong is one of those economies.

2. With extensive work done and solid foundation established, the Census and Statistics Department (C&SD) of Hong Kong formally implemented this new principle in compiling trade in goods and services statistics under the Balance of Payments (BoP) and Gross Domestic Product (GDP) compilation frameworks since September 2012.

3. During the implementation and development processes, the Department had been actively participating in international deliberations on this new development. A number of papers[1] presenting Hong Kong's experience in studying the impact and drawing up the implementation plan of this new principle had been discussed among the international statistical communities on different occasions. Also, statistical surveys had been enhanced and developed for collecting the additional source data required. These data not only support the implementation of the new principle, but also facilitate better understanding of the processing trade and merchanting activities of Hong Kong.

4. Building on the deliberations and materials discussed in previous papers, this paper summarises the development work in implementing the new principle in Hong Kong, and provides an updated analysis of the latest development of processing trade and merchanting activities of Hong Kong with reference to the new data collected in recent years.

II. Profile of processing trade and merchanting activities of Hong Kong before implementation of the new principle

5. Hong Kong is one of the most externally oriented economies in the world. In 2012, Hong Kong was ranked the 9th largest trading economy in the world in terms of total value of external merchandise trade. The ratio of Hong Kong's total merchandise trade value to its GDP was around 360% in 2013.

6. Trading activities related to goods sent abroad for processing and merchanting play a vital role in the external trade of Hong Kong. As early as in the 1980s, many manufacturing companies in Hong Kong started to relocate their production processes to Mainland China to take advantage of the geographical proximity and lower production cost there. Raw materials and semi-manufactures are transported to factories in Mainland China for processing and the processed goods are returned to Hong Kong for local consumption and / or re-exportation. During the 1990s, goods sent to Mainland China for processing and subsequently returned to Hong Kong have been the driving force of Hong Kong's trade

[1] Two papers were presented at the meetings of the IMF Committee on Balance of Payments Statistics (BOPCOM) in 2007 and 2008. Similar paper as the original version of the BOPCOM paper no. 07/20 was presented subsequently at the 2008 Conference of European Statisticians organised jointly by the United Nations Economic Commission for Europe and the United Nations Statistical Commission in June 2008 and the first meeting of the Organisation for Economic Cooperation and Development Working Party on International Trade in Goods and Trade in Services Statistics in September 2008. In 2012, a paper was prepared for the BOPCOM meeting.

with Mainland China, as evidenced by the increasing share of processing trade in Hong Kong's imports from Mainland China (Figure 1a) and lower growth rates of value of imports from Mainland China after excluding the value of the processed goods (Figure 1b) during that period.

Figure 1a
Share of processing trade in Hong Kong's imports from Mainland China

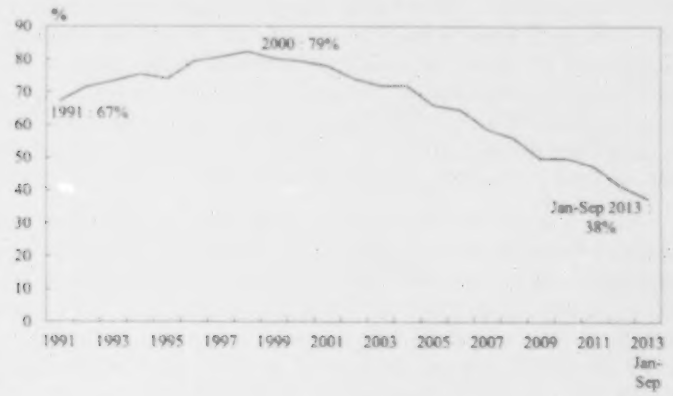
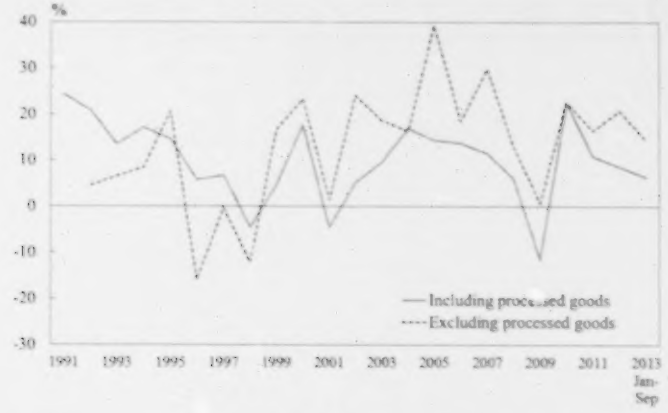


Figure 1b
Growth rates of value of imports from Mainland China



7. During the 2000s, structural changes in processing trade between Hong Kong and Mainland China started to take place. While imports of goods after processing in Mainland China continued to increase, the growth rates were milder compared with non-processing trade. As a result, the share of processed goods returned to Hong Kong in the total imports from Mainland China to Hong Kong declined, while the growth rates of value of imports from Mainland China after excluding the value of the processed goods became higher (Figures 1a and 1b). Latest survey data indicated that in 2013, about 40% of imports of goods from Mainland China were related to goods returned after processing, which fell significantly from the corresponding ratio of around 80% recorded in 2000.

8. New data collected for the implementation of the change of ownership principle provide insights into the driving forces of structural changes in processing trade between

Hong Kong and Mainland China. Of the goods sent to Mainland China for processing in 1990s, the majority was under the arrangement of "processing and assembling" (P&A)[2], in which the raw materials sent to Mainland China for processing and the finished output after processing remained to be the property of Hong Kong companies throughout, i.e. there was no change of ownership. The processed goods would normally be returned to Hong Kong for subsequent re-exportation to overseas markets. During the 2000s, processing arrangements were gradually shifted to "processing with imported materials" (PIM). Under the PIM arrangement, the ownership of the imported inputs is transferred to the processing units in Mainland China, and the processed goods might not be returned to Hong Kong. As a result of the shift from P&A to PIM arrangement, the volume of processed goods returned to Hong Kong registered only moderate increases in the 2000s as compared that in the 1990s. For the implementation of change of ownership principle, new data on processing trade under both P&A and PIM arrangements are collected. The new data also support analysis of the structural changes from P&A to PIM arrangements at broad industry level, which will further be discussed in paragraph 20 below.

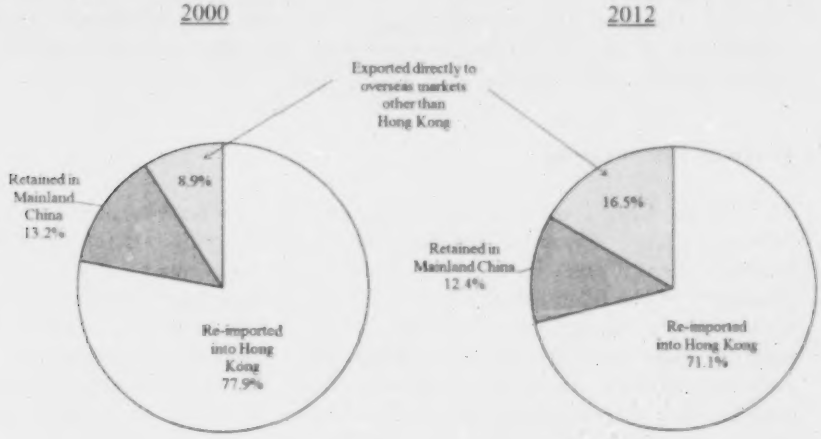
9. As for the disposal of processed goods, while re-importation into Hong Kong still remained as the major mode, its share (as a percentage of the value of raw materials/semi-manufactures sent to Mainland China for processing) had somewhat declined in the past decade or so, from 78% in 2000 to 71% in 2012 (Figure 2). On the other hand, the share of processed goods exported directly to overseas markets had gradually increased, from around 9% to 17% during the same period, along with the infrastructural development and improvement in logistics arrangements in Mainland China. Part of these goods are processed under the P&A arrangement, and hence should be recorded as exports of goods of Hong Kong instead of Mainland China under the change of ownership principle. Capturing of data related to this type of trade, viz. offshore trade activities involving outward processing, is discussed in paragraphs 16 - 18 below.

[2] According to Mainland China Customs' definitions, there are two types of inward processing trade, viz.: *processing and assembling* and *processing with imported materials*. *Processing and assembling* refers to the type of inward processing in Mainland China in which foreign suppliers provide all or part of the raw materials, parts or components under a contractual arrangement for the manufacture or assembling of products, which are for subsequent exportation from Mainland China by the foreign suppliers. Under this type of processing, the imported inputs and the finished outputs remain to be the property of the foreign suppliers throughout the whole process. *Processing with imported materials* refers to the type of inward processing in Mainland China in which the raw materials, parts and components are purchased with foreign currencies and imported by Mainland China's processing units for the manufacture of products or semi-manufactures, which are for subsequent exportation to foreign markets from Mainland China. Under this type of processing, the ownership of the imported inputs has been transferred to Mainland China's processing units. In compiling trade in goods and services statistics of Hong Kong under the new principle, adjustments are needed only for Hong Kong's outward processing in Mainland China under *processing and assembling* contracts.

Figure 2

Intention of final disposal of goods after processing in Mainland China

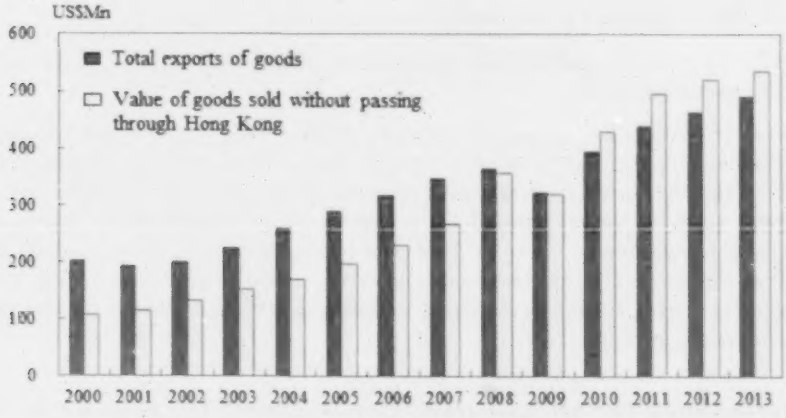
(as a percentage of the value of raw materials / semi-manufactures sent to Mainland China for processing)



10. On the other hand, merchanting activities undertaken by Hong Kong companies have prospered since the 2000s. Hong Kong traders engage in a substantial amount of merchanting activities to take advantage of their extensive trading network with buyers and sellers in the global market. The total value of goods sold without passing through Hong Kong amounted to US$535 billion in 2013, about 5 times the value in 2000. Also, the value had become higher than the overall value of total exports of goods of Hong Kong since 2010 (Figure 3).

Figure 3

Value of goods sold without passing through Hong Kong and exports of goods of Hong Kong



III. Implementation of the new principle in Hong Kong

11. Companies in Hong Kong typically undertake three types of processing trade and merchanting activities: (i) outward processing, (ii) merchanting, and (iii) offshore trade activities involving outward processing. The following paragraphs highlight the development of new statistical surveys for these three types of trade in recent years that underpinned the implementation of the new principle.

A. Outward processing

12. Hong Kong's outward processing activities are predominantly carried out in Mainland China. Given the importance of processing trade between Hong Kong and Mainland China, C&SD has long been conducting the Survey on Trade Involving Outward Processing in the Mainland of China (OP Survey) since late 1980s to capture data on outward processing activities. The OP Survey is conducted on a monthly sample of import / export trade declarations. While basic information regarding the sampled consignments (such as trade type, trade value, commodity type and market) can be collated from the trade declarations, the required information on outward processing is obtained by computer-assisted telephone interviews with the establishments concerned.

13. For the purpose of implementing the new principle, the OP Survey has been enhanced since the second quarter of 2008 to collect additional data in respect of the P&A contracts. Enhancements include collecting additional information on the following items pertaining to imports from Mainland China which involve outward processing of goods under the P&A arrangement:

(a) value of raw materials/semi-manufactures sent from Hong Kong to Mainland China;

(b) value of raw materials / semi-manufactures purchased and delivered directly from places other than Hong Kong to Mainland China;

(c) value of manufacturing services on physical inputs owned by Hong Kong, with the following breakdowns:

(i) processing fees paid by Hong Kong; and

(ii) raw materials/semi-manufactures procured directly by Mainland China's processing units.

14. To support the compilation of more detailed trade statistics under the change of ownership principle and the conduct of more in-depth trade analysis, the quarterly sample size of the OP Survey has been enlarged significantly (more than doubled) over the past several years. This has enabled the compilation of reliable estimates of the aforesaid additional breakdowns. To meet the timeliness requirement of GDP and BoP estimates, partial survey results and data models have been used to produce, at shorter time lag, preliminary estimates of goods related to outward processing trade at an aggregate level under the new principle.

B. Merchanting and offshore trade activities involving outward processing

15. Considering the significance of merchanting activities in Hong Kong's trade in services, C&SD has been collecting data related to merchanting activities via the Annual Survey of Imports and Exports of Services (ASIES) since the 1990s. Data on the sales of

goods and cost of goods sold under merchanting are regularly collected to compile the value of merchanting services provided by Hong Kong traders.

16. Offshore trade activities involving outward processing refer to trading activities in which goods are processed under P&A contracts, and subsequently sold to non-residents directly without the goods passing through Hong Kong. Under the previous treatment, the gross margin of offshore trade activities involving outward processing was recorded as trade in services. However, as the goods sold involve actual buying and selling activities (with a change of ownership), the new principle stipulates that sales of such goods should be recorded as trade in goods. The processing fee involved is to be recorded as import of manufacturing services on physical inputs owned by Hong Kong traders.

17. To meet the data requirements on merchanting arising from the new principle in a timely manner, C&SD has implemented a new Quarterly Survey of Merchanting and Other Trading Activities (QSMTA) since the first quarter of 2010. However, only aggregate data are collected to minimise respondent burden. More detailed data, e.g. the value of sales of goods under merchanting by broad commodity group and by country / territory, continue to be collected on an annual basis via the ASIES.

18. Apart from collecting the value of sales and cost of goods sold under merchanting, the new quarterly survey also collects additional data related to offshore trade activities involving outward processing, which cannot otherwise be collected from trade declarations or the OP Survey of which the reporting unit is based on trade declarations, as these goods do not cross the boundary of Hong Kong. The following additional data are collected on offshore trade activities involving outward processing activities via the QSMTA:

(a) value of goods sold offshore after processing;

(b) cost of goods sold offshore after processing, with further breakdowns into:

(i) value of raw materials / semi-manufactures sent from Hong Kong to the processing economy;

(ii) value of raw materials / semi-manufactures purchased and delivered directly from places other than Hong Kong to the processing economy;

(iii) value of manufacturing services on physical inputs owned by Hong Kong, with the following breakdowns:

- processing fees paid by Hong Kong; and
- raw materials / semi-manufactures procured directly by the processing units abroad.

19. On average, about 2 000 establishments are selected for enumeration in each survey round of QSMTA, of which 800 are certainty cases. These certainty cases have been identified to be very prominent in terms of trade in services or merchanting receipts, based on the survey returns in previous rounds of ASIES and QSMTA. The coverage of the QSMTA is reviewed on an annual basis to ensure a good representation of establishments engaged in merchanting and trade in services activities in the survey.

IV. Results of the enhanced and new surveys

A. Enhanced survey on outward processing

20. The enhanced OP Survey enables detailed analysis of the processing arrangements between Hong Kong and Mainland China. Firstly, as mentioned in paragraph 8 above, the

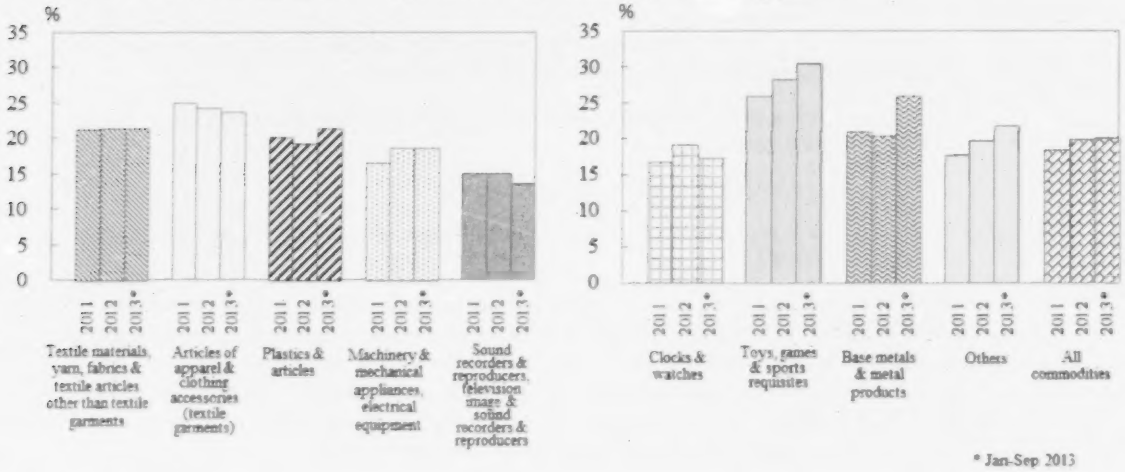
share of goods processed under the P&A arrangement in total imports from Mainland China has declined. Analysed by industry, for companies with significant amounts of processing trade and engaged in trading of electronic parts, P&A arrangement used to be the preferred mode of operation. In recent years, a shift to PIM arrangement has been observed. Similar pattern has also been observed for companies with significant amounts of processing trade and engaged in trading of fabrics. On the other hand, companies engaged in trading of jewellery and electrical goods have generally continued to rely more on P&A arrangement.

21. Secondly, the enhanced OP Survey provides new data for analysis of components of inputs consumed in the manufacturing process. In particular, the survey results showed that overall speaking, value of manufacturing services accounted for around 20% of the value of processed goods. The remaining 80% were raw materials/semi-manufactures procured by the Hong Kong traders for processing. Within this, around 70% were raw-materials / semi-manufactures sent from Hong Kong to Mainland China while 10% were raw-materials/semi-manufactures purchased and delivered directly from places other than Hong Kong to Mainland China.

22. When analysed by broad commodity group, for commodity groups (a) toys, games and sports requisites, and (b) base metals and metal products, the shares of value of manufacturing services in the value of processed goods were relatively high, at 30% and 26% respectively in early 2013. The higher shares were attributable to the larger labour input required. In addition, for toys, games and sports requisites, the greater amount of inputs of raw materials / semi-manufactures procured directly by the processing units abroad, being treated as part of the manufacturing services, also accounted for the higher share. On the other hand, for sound recorders and reproducers, television image and sound recorders and reproducers, the share of manufacturing services was just 14% in the value of processed goods in early 2013 (Figure 4).

Figure 4

Share of value of manufacturing services in the value of processed goods



* Jan-Sep 2013

B. New survey on merchanting and offshore trade activities involving outward processing

23. As discussed in paragraph 9 above, another form of processing has emerged, in which goods are sold offshore after processing, without returning to Hong Kong. This type of processing arrangement commonly takes place in manufacturing factories in Mainland China, Vietnam, etc. According to the QSMTA results, among all the goods sold offshore (i.e. goods sold and delivered to buyers without crossing the boundary of Hong Kong and hence cannot be captured under the customs system) in 2013, about 5% (in terms of sales value) were having P&A processing arrangement outside Hong Kong. The remaining 95% were goods sold under merchanting, i.e. goods bought and sold offshore without outward processing arrangement.

24. The QSMTA results also indicated that the trade margin for goods sold offshore after processing was higher than that for goods sold under merchanting (10% and 6% respectively in 2013). In 2013, of the cost of goods sold offshore under the P&A arrangement:

(a) around 40% was related to raw-materials / semi-manufactures sent from Hong Kong to the processing economy;

(b) around 30% was related to raw-materials / semi-manufactures purchased and delivered directly from places other than Hong Kong to the processing economy;

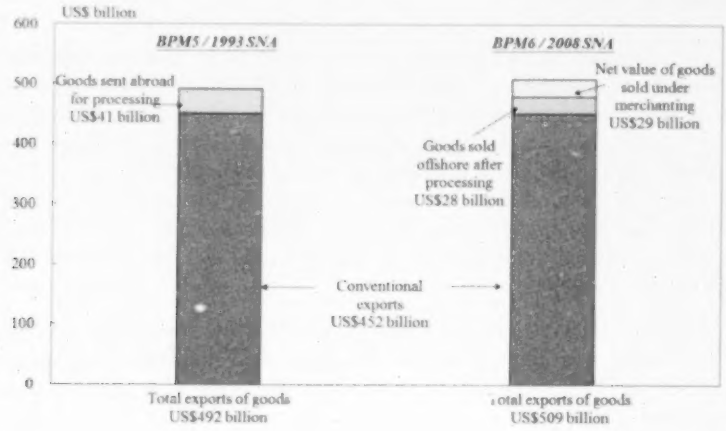
(c) around 30% was related to manufacturing services on physical inputs owned by Hong Kong, which include processing fees paid by Hong Kong and value of raw-materials / semi-manufactures procured directly by the processing units abroad.

V. Impact on trade in goods and services statistics of Hong Kong

25. The statistics compiled using the new principle are useful for the analysis of various aspects of globalisation in the international trade of Hong Kong. Based on the estimates for the reference year of 2013, the following paragraphs present some salient analyses of the impact of adopting the new principle on the trade in goods and services statistics of Hong Kong.

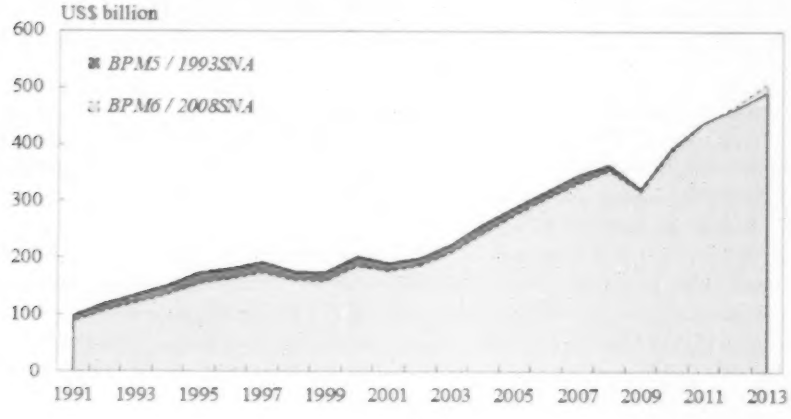
26. Trade in goods statistics compiled using the new principle can better reflect the genuine trade value of Hong Kong, irrespective of whether the goods traded pass through the boundary of Hong Kong. Under the change of ownership principle stipulated in *BPM6 / 2008 SNA*, exports of goods were estimated to be US$509 billion in 2013. Of the US$492 billion of exports of goods compiled using the old principle (based on *BPM5 / 1993 SNA*), US$41 billion of goods sent abroad for processing under P&A arrangement were excluded. The remaining US$452 billion represented conventional exports of goods (Figure 5). On the other hand, US$28 billion of goods sold offshore after processing and US$29 billion net value of goods sold under merchanting were added. As a result, the value of exports of goods in 2013 compiled using the new principle (US$509 billion) was higher than that compiled using the old principle.

Figure 5
Exports of goods compiled using the old and new principles, 2013



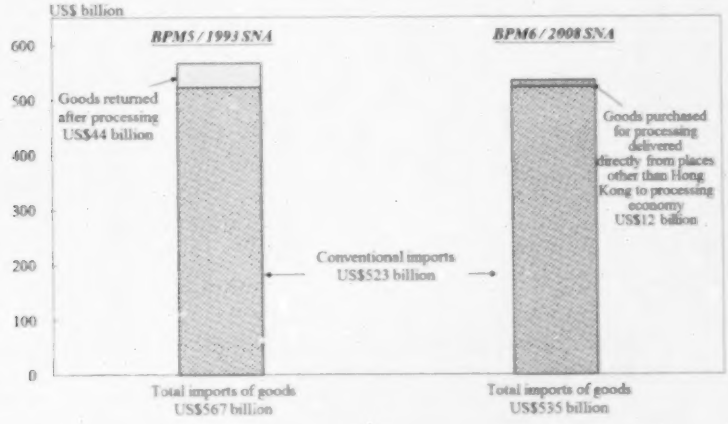
27. It is interesting to note that the value of exports of goods compiled using the new principle has become higher than that compiled using the old principle only since 2012 (Figure 6). Before that, the reverse was true, i.e. exports of goods compiled using the new principle had a smaller value. The gap narrowed gradually, from about 9% in 2000 to 2% in 2010, mainly because of moderation in the growth of goods sent abroad for processing caused by the structural shift from P&A to PIM arrangement as mentioned in paragraph 8. On the other hand, goods sold offshore after processing and the net value of goods sold under merchanting continued to prosper, which more than offset the decline in respect of goods sent abroad for processing under P&A arrangement.

Figure 6
Exports of goods compiled using the old and new principles



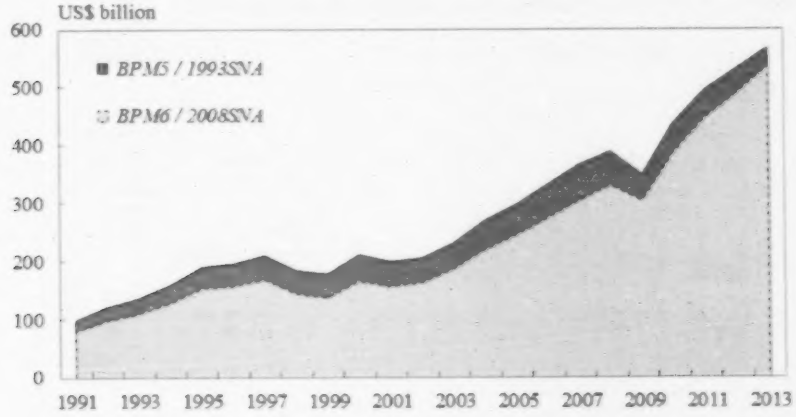
28. For imports of goods, the value compiled using the new principle amounted to US$535 billion in 2013, smaller than that using the old principle (US$567 billion). The new statistics reflect more closely the value of goods procured by Hong Kong traders for engaging in international trading activities, irrespective of whether the goods are actually imported into Hong Kong. The new statistics exclude goods returned to Hong Kong after processing in the processing economy (i.e. goods processing under P&A arrangement) (US$44 billion), but include raw materials / semi-manufactures purchased by Hong Kong companies and delivered directly from places other than Hong Kong to the processing economy (US$12 billion) (Figure 7).

Figure 7
Imports of goods compiled using the old and new principles, 2013



29. Similar to exports of goods, the discrepancies between the values of imports of goods compiled using the old and new principles were getting smaller as a result of the structural change from P&A to PIM arrangement (Figure 8). In 2000, the value of imports of goods compiled using the new principle was about 22% smaller than that compiled using the old principle. The gap was reduced to 12% in 2010 and further to 6% in 2013.

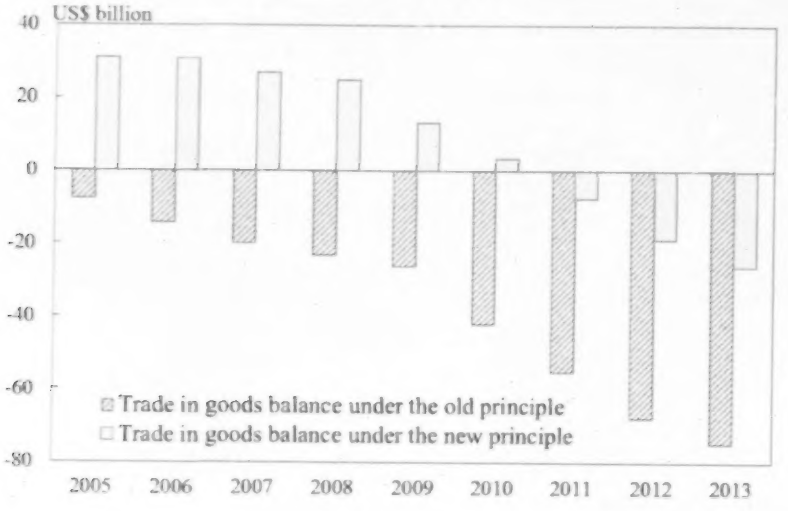
Figure 8
Imports of goods compiled using the old and new principles



30. After implementing the new principle, the balance of trade in goods of Hong Kong generally exhibited a structural change in past years (Figure 9). The trade in goods surplus recorded under the new principle before 2011 was largely due to the exclusion of trade in goods sent abroad for processing and the inclusion of the net value of goods sold under merchanting in exports of goods. Nevertheless, from 2011 onwards, the balance of trade in goods recorded a deficit under the new principle, which was mainly attributable to the rather buoyant import demand for supporting consumption and inbound tourism locally.

Figure 9

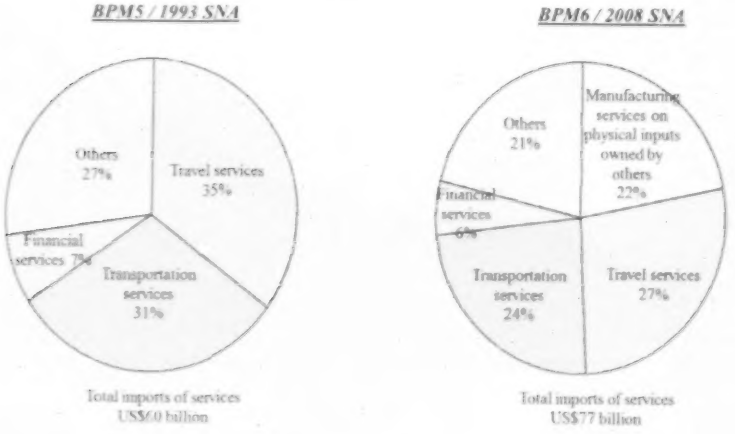
Balance of trade in goods compiled using the old and new principles



31. As regards trade in services, the statistics compiled using the new principle showed that Hong Kong imported a substantial amount of manufacturing services on physical inputs owned by Hong Kong companies in 2013, with an estimated value of US$17 billion. This accounted for 22% of total imports of services (US$77 billion) in 2013, and reflected Hong Kong's active involvement in the outward processing activities. The composition of imports of services in 2013 under the new and old principles is shown in Figure 10.

Figure 10

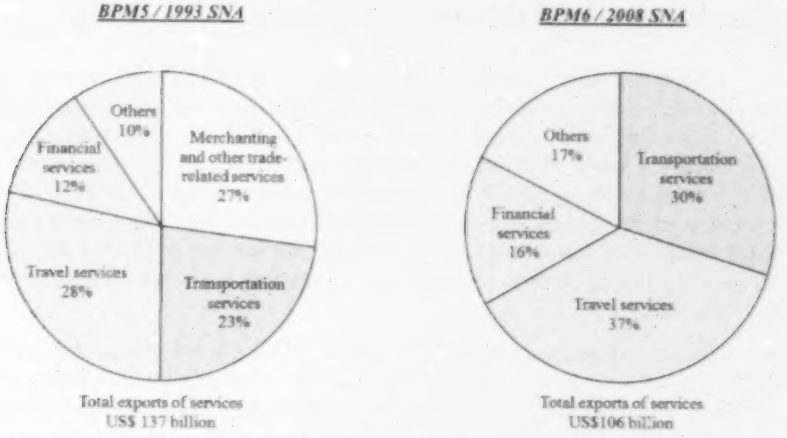
Imports of services compiled using the old and new principles, 2013



32. For exports of services, the gross margin of merchanting is taken out under the new principle, as merchanting is now recorded as trade in goods rather than trade in services. The total exports of services compiled using the new principle amounted to US$106 billion in 2013, with major components shown in Figure 11. In comparison, the total exports of services in 2013 compiled using the old principle stood at US$137 billion.

Figure 11

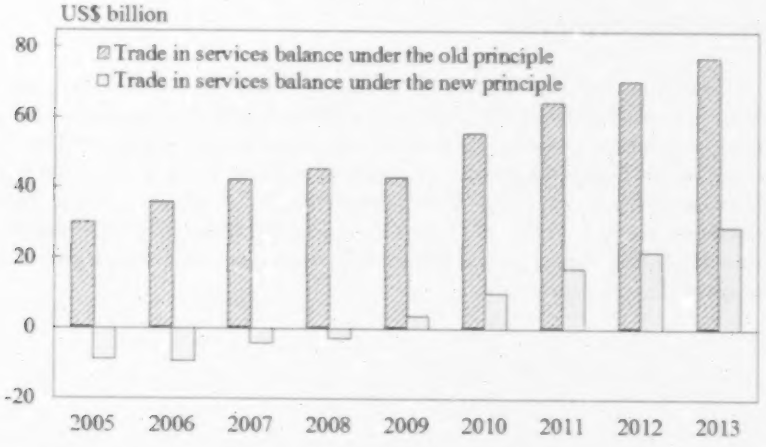
Exports of services compiled using the old and new principles, 2013



33. The implementation of the new principle generally changed the balance of trade in services of Hong Kong from surplus to deficit before 2009, due to the exclusion of exports of merchanting services and inclusion of imports of manufacturing services on physical inputs owned by others (Figure 12). Yet, from 2009 onwards, the balance of trade in services saw an increasing surplus, as imports of manufacturing services declined while exports of travel services and financial services grew significantly in those years.

Figure 12

Balance of trade in services compiled using the old and new principles



34. As the implementation of the new principle alone involves only the re-classification of components of trade in goods and services, the overall balance of trade of goods and services of Hong Kong remains unchanged, though the balance of trade in goods and the balance of trade in services both record significant changes individually as described above.

This implies that the levels and growth rates of overall GDP and the overall current account balance under BoP are not affected by the implementation of the new principle.

35. As for the estimation of volume measures of various components of trade in goods and services under the new principle, particularly processing fees paid to non-resident processing units and material inputs bought by non-resident processing units, reference is made to Mainland China's producer price indices of manufactured goods, broken down into raw material costs and processing fees.

VI. Dissemination of the new statistics in Hong Kong

36. To ensure users' correct understanding and applications of the trade in goods and services statistics compiled under the new principle, consultations and discussion sessions with major data users in both the public and private sectors of Hong Kong have been undertaken to solicit their views and suggestions regarding the introduction of the new principle in recording goods for processing and merchanting. While our major users generally appreciate and support the implementation of the new principle in the BoP and GDP compilation frameworks, some of them indicate preference for the provision of a transition period to allow them more time in adapting to the statistics compiled using the new principle.

37. In this connection, for the new trade in goods and trade in services components in GDP estimates, a special interim dissemination arrangement is adopted whereby the conventional trade statistics in the existing GDP framework continue to be published in the quarterly GDP report, while the new data series based on the change of ownership principle are presented as supplementary tables in the same report. Nevertheless, the overall GDP levels and growth rates remain unchanged under both the old and new presentation formats.

38. For BoP statistics, only the new trade in goods and services figures are presented in the quarterly BoP report, considering that analyses in the context of BoP often focus more on the balances of broad components in the current account (e.g. goods and services balance or current account balance, which will be the same under the old and new principles) and their relationships with the financial account.

VII. Concluding remarks

39. Hong Kong has implemented the change of ownership principle in compiling trade in goods and services statistics under the GDP and BoP frameworks. The new data captured in enhanced statistical surveys not only underpin the implementation of the new principle, but also support more detailed analysis of the processing trade and merchanting activities undertaken by Hong Kong companies. To ensure smooth transition in disseminating the new series of trade in goods and services statistics under the GDP framework, we will maintain close liaison with major users to promote greater awareness and usage of the new data series.

VIII. References

United Nations Economic Commission for Europe (2011): *The Impact of Globalization on National Accounts* (Report). United Nations.

Census and Statistics Department (2007): *Strategy for Implementing Recommendations on Goods for Processing and Merchanting in BPM6 - The Case for Hong Kong* (BOPCOM-07/20). C&SD Hong Kong.

Census and Statistics Department (2008): *Implementing the New Statistical Standards for Goods for Processing and merchanting in Hong Kong, China* (BOPCOM-08/12). C&SD Hong Kong.

Census and Statistics Department (2012): *Implementation of the Change of Ownership Principle in Compiling Trade in Goods and Services Statistics of Hong Kong* (BOPCOM-12/06). C&SD Hong Kong.

Census and Statistics Department (2012): *Special Report on Gross Domestic Product* (Report). C&SD Hong Kong.

Census and Statistics Department (2012): *Hong Kong's Trade Involving Outward Processing in the Mainland of China, 2001 to 2011* (Feature Article). C&SD Hong Kong.

Census and Statistics Department (2013): *Hong Kong's Outward Processing Trade with the Mainland of China under the Arrangements of Processing and Assembling* (Feature Article). C&SD Hong Kong.

United Nations ECE/CES/GE.20/2014/21

Economic and Social Council

Distr.: General
10 April 2014

English only

Economic Commission for Europe

Conference of European Statisticians

Group of Experts on National Accounts

Thirteenth session
Geneva, 6-9 May 2014
Item 7 of the provisional agenda
Globalization and national accounts: accounting for global production

Quantification of property income of non-residents

Prepared by Czech Statistical Office

Summary

The paper presents the experience of the Czech statistical office in implementation of the System of National Accounts 2008 / the European System of National and Regional Accounts 2010 and the sixth edition of the Balance of Payments and International Investment Position Manual. It mainly addresses the challenges in ensuring conceptual compliance between the two standards due to the recording of dividends arising from the hidden economy and reinvested earnings on direct foreign investment quantified based on business and national accounting principles.

GE.14-21938

1421938

Please recycle

I. Introduction

1. Implementation of the System of National Accounts 2008 (2008 SNA) and the sixth edition of the Balance of Payments and International Investment Position Manual (BPM6) is widely declared as bringing in the full conceptual compliance. However, is this conceptual compliance achievable in practice? Two examples of the current Czech practice show that the full compliance will be very difficult to reach because some important inconsistencies between National Accounts and Balance of Payments approaches will follow: (1) dividends arising from the hidden economy, and (2) reinvested earnings on direct foreign investment quantified based on business and national accounting principles.

II. Dividends arising from the hidden economy

2. According to our estimates, the non-observed economy represents almost 12% of gross domestic product (GDP) in the Czech Republic. The biggest part of this economy comprises the intentional misreporting of officially reported data, referred to under code N6 of Eurostat tabular approach types of non-exhaustiveness. This is a deliberate misreporting of data reported both by natural persons as well as legal business entities.

3. The estimates for natural persons are based on the balance of work, compari g labour productivity and rates of over-declared expenditure and under- declared revenues in official surveys. While for the legal persons they are based on the rates only. These rates are derived from an anonymous enquiry among accountants and tax advisers about their opinion on the degree of overestimation of expenditure and the under-estimation of incomes for different types of units, differentiated by size and activity. Now we use the results from the latest survey conducted in the year 2009 (see table 1). A similar survey was made also in 1999, then in 2006.

Table 1
Rates of distortion in officially reported data by NACE

Revenues								
Number of employees/ CZ-NACE	A+B	D	F	G	H	I	K	M+N
1-19	6,67	2,78	9,59	4,26	21,31	1,25	0,68	6,77
20-99	1,80	0,20	7,23	0,35	1,75	1,77	0,14	1,43
Material								
Number of employees/ CZ-NACE	A+B	D	F	G	H	I	K	M+N
1-19	4,50	2,88	7,61	4,26	5,92	1,65	0,41	4,09
20-99	0,45	0,83	5,45	0,23	1,15	1,35	0,17	1,65
Services								
Number of employees/ CZ-NACE	A+B	D	F	G	H	I	K	M+N
1-19	1,50	2,53	8,63	4,26	6,79	4,30	0,66	4,09
20-99	0,45	1,17	7,39	0,14	0,70	2,02	0,40	3,99
Non-reported wages								
Number of employees/ CZ-NACE	A+B	D	F	G	H	I	K	M+N
1-19	4,47	1,68	8,61	9,33	15,12	14,10	2,11	4,99
20-99	0,45	2,00	9,13	4,14	7,75	11,00	1,66	5,16

4. On the basis of these data, we estimate the undeclared income, overestimated intermediate consumption and undeclared wages, or black work. The estimate is made for the small and medium units only, i.e. not for the big companies, which have a compulsory audit of their economic results. When dealing with the procedures of our estimates of the hidden economy we cannot avoid the question "Is there also any distorting of business accounts by companies owned by non-residents?" The reality is that foreign owners quickly adapt to local customs. And also, if the economic environment in the host country allows it there is no reason why not to do it, and also when they do it in their home country.

5. The calculations therefore include all private small and medium scale companies without any confirmation who is owner. The resulting income appropriated by their owners (resident and non-resident households) is in the form of "undeclared" dividend. However, this is a reason for significant discrepancy between the principles of recording in national accounts and balance of payments. While in the national accounts is a priority completeness of capture, the balance of payments emphasises targeting. To identify the dividends arising from hidden economy by country of origin of their owners does not make sense. The emphasis on territorial identification of flows is a reason why such dividends are not explicitly recorded in the balance of payments, and so there is a serious discrepancy between the figures from balance of payments and national accounts.

Table 2
Deliberately misreporting, Czech Republic, 2011, (CZK, bill)

		Producers (legal units)	
		S.11002	*S.11003*
P.1	Output	50,9	8,4
P.2	Intermediate consumption	-30,4	-6,1
D.11	Wages and salaries	15,4	3,0
B.2	Operating surplus	66,0	11,4
D.421	Dividends	66,0	11,4
B.6	Disposable income	0,0	0,0

6. Figures for the year 2011 can serve as an example. Our estimate of intentional misreporting of the reported data (N6) for legal entities and their recording in national accounts is shown in the Table 2. The total discrepancy between "Current external balance (B.12)" by BoP (CZK 104.0 billion) and by national accounts (CZK 133.7 billion) amounted to 29.7 billion CZK this year. The discrepancy arising from hidden economy (not declared dividends) represents almost half of total discrepancy.

III. Reinvested earnings on foreign direct investment

7. Reinvested earnings on foreign direct investment (RIE) quantified based on business and national accounting principles give different results. The current method of the RIE estimation in the Czech Republic is directly based on the information from business accounting without any further adjustments. Under the main revision of the Czech national accounts, joined with the implementation of the European System of National and Regional Accounts 2010 (ESA 2010), the Czech statistical office introduced new method based on national accounts data.

8. The current calculation is provided by Czech National Bank using direct sample survey without grossing up. The population of the survey consists of 4500 reporting units. On each of them the calculation is applied by next formula: RIE = Profit after taxation – extraordinary profit – (Dividends – extraordinary Dividends)

9. All information is based on business accounting principles (Czech or International Financial Reporting Standards (IFRS)). As further adjustments are not applied this approach is not consistent with national accounts compiled by the Czech Statistical Office. Main methodological differences are definition of profit (business accounting (BA) profit includes financial profit), consumption of fixed capital vs. amortization by national legislation, excluding of holding gains and other conceptual differences.

10. The new approach introduced by the Czech Statistical Office directly follows the manua' ESA 2010: § 4.64: Reinvested earnings on foreign direct investment (D.43) are equal to the operating surplus of the foreign direct investment enterprise, plus any property incomes or current transfers receivable, minus any property incomes or current transfers payable, including actual remittances to foreign direct investors and any current taxes payable on the income, wealth, etc., of the foreign direct investment enterprise.

11. This definition in fact corresponds to the balancing item Net disposable income (B.6n) in both non-financial and financial corporation sectors (S.11 and S.12).

12. Calculation for non-financial corporations (S.11) is made in three steps: (1) calculation of the net disposable income based on business accounts data, (2) calculation of the approximated share of foreign direct investment on net disposable income (ASFDI) and (3) application of the ASFDI on final net disposable income including all conceptual and exhaustiveness' adjustments. A numerical example for sub-sector foreign controlled non-financial corporations (S.11003) follows.

Box 1

Calculation for non-financial corporations of sub-sector S.11003

The 1st step: At first the net disposable income is calculated for total and for "foreign direct investment (FDI)" part of individual units based on business accounts data sources. The "FDI net disposable income" is calculated by individual shares of FDI in total equity of individual units based on SBS data source. Both, total and "FDI" net disposable income are sum of disposable incomes calculated for individual units as follows:

B.6n = (P.1 – P.2 – D.1 – D.2 + D.3 +D.4r - D.4u –D.5u + D.7r –D.7u – K.1]* (% of share of foreign owners]

B.6n for total S.11003 = 126.344 mill. CZK

B.6n for "FDI part" in S.11003 = 84.446 mill. CZK

The 2nd step represents a calculation of the approximated share of net disposable income derived from FDI (ASFDI) as sum of individual shares of foreign owners multiplied by the share of "FDI net disposable income" on total net disposable income by appropriate subsector:

ASFDI (S.1xxxx)= sum (% of share of foreign owners x B.6n of FDI unit)/ B.6n(S.1xxxx)

ASFDI(11003) = 84.446/126.344 = 0,668

The 3rd step: Then approximated share of FDI is applied on the final net disposable income including all NA adjustments (85.984 mill.CZK) which ensure that indicators are fully consistent with ESA standards and the whole System of National Accounts.

D.43 = ASFDI x B.6n (including all NA adjustments)

D.43 (11003) =0,668 x 85.984 = 57.463 mill. CZK

13. Calculation for financial corporations (S.12) is similar like for non - financial corporations with two exceptions: (1) there are differences in calculation of ASFDI due to differences in data sources and (2) for pension funds from the "FDI net disposable income"

has to be subtracted the change in pension entitlements (D8), so there is used "FDI net savings"

Table 3

Reinvested earnings by new and current method, Czech Republic, 2011, (CZK, bill)

Institutional sector		*ASFDI*	*New approach*	*Current approach*	*Difference*
		(%)	*mill.CZK*	*mill.CZK*	*mill.CZK*
S.11001	Public non-financial corporations	0,09%	0	464	-464
S.11002	National private non-financial corporations	-16,46%	-740	-5 905	5 165
S.11003	Foreign controlled non-financial corporations	66,80%	57 463	32 932	24 531
S.11	**Non-financial corporations**	**X**	**56 723**	**27 491**	**29 232**
S. 122	Deposit-taking corp. except the central bank	75,00%	30 476	10 414	20 062
S. 124	Non-MMF investment funds	-10,00%	-192	-71	-121
S. 125	Other financial intermediaries, except IC and PF	42,70%	8 871	-8 785	17 656
S. 126	Financial auxiliaries	59,60%	5 068	366	4 702
S. 127	Captive financial institutions and money lenders	64,00%	7 938	21 621	-13 683
S. 128	Insurance corporations	84,00%	-3 103	-7 139	4 036
S. 129	Pension funds	26,00%	184	1 185	-1 001
S.12	**Financial corporations**	**X**	**49 242**	**17 591**	**31 651**
S.1	**Total economy**	**X**	**105 965**	**45 082**	**60 883**

14. The results calculated by new method and differences compare to old method shown in table 3 are preliminary and will be refined during ongoing compilation work on main revision of national accounts. We expect that the differences will be higher according to ESA 2010 due to new conceptual adjustments, like capitalisation of research and development and others.

15. New results ensure not only compliance with ESA standards but also follow the real meaning of reinvested earnings from FDI. Previous calculation caused that Czech corporations seemed be richer than in reality. Reinvested capital increased expression of net worth value of these corporations instead of increasing the value of cross-border shares.

16. The new approach will include all necessary adjustments to achieve consistency with ESA 2010 standard but these calculations could not be accepted by Czech National Bank for compiling of Balance of Payment because of Eurostat's requirement (BoP) - mainly due to absence of direct territorial structure. So, it will be next reason of relatively big differences between National Accounts and Balance of Payment figures in future.